Mars Multimedia
99 Mansell Street
London
E1 8AX,
ENGLAND

MARIS

Technical support
information is
available on the World
Wide Web
at www.mars.com/mars/

Internet:
redshift@mars.com
CompuServe: 100136,2705
AppleLink: REDSHIFT

USER'S GUIDE

REDSHIFT 2

MULTIMEDIA ASTRONOMY

© MARIS MULTIMEDIA 1993-1995

MARIS

USER'S GUIDE

REDSHIFT 2

MULTIMEDIA ASTRONOMY

User's Guide

Dedication

Maris Multimedia respectfully dedicate RedShift 2
to the brave men and women of the Russian space program

Redshift:

The increase in the wavelength of light from an object such as a galaxy, normally caused by the object moving away from the observer. The Redshift of a galaxy indicates its distance from the Earth.

RedShift 2 Multimedia Astronomy

Copyright © 1993, 1994, 1995 Maris Multimedia Ltd and its licensors. All rights reserved.

Licensors' copyrights:

Penguin Dictionary of Astronomy © Jacqueline Mitton 1991, 1993. All rights reserved.
NGC 2000.0 © 1989, Sky Publishing Corporation, Cambridge MA02138, USA. All rights reserved
Ephemerides of Minor Planets © 1992, Institute of Theoretical Astronomy of the Russian Academy of Sciences
Original: music: ℗1995 Edition Incontro, © 1995 Ullstein Soft Media

Photographs

AAT (Anglo-Australian Telescope) photographs © Anglo-Australian Telescope Board, The Anglo-Australian Observatory, PO Box 296, Epping, NSW 2121, Australia, photographs by David Malin
UK Schmidt photographs © ROE/Anglo-Australian Telescope Board, photographs by David Malin
Smithsonian Institute photographs © Smithsonian Astrophysical Observatory
Photographs of engravings from the Bayer Uranometria (1723 ed.) © Royal Astronomical Society Library
Photographs of engravings from the Flamsteed Atlas Coelestis (1729 ed.) © Royal Astronomical Society Library
Where applicable, the copyright ownership of all other photographs is as stated in the Photo Gallery

Acknowledgments

Maris wish to acknowledge the following sources:
Surface maps of planets and moons by courtesy of US Geological Survey and NASA
Venus surface map by kind permission of NASA and University of London Department of Astronomy
DE 102 orbital data by courtesy of Jet Propulsion Laboratory (special thanks to E. M. Standish)
Theory of Motion of Jupiter's Galilean Satellites, J H Lieske 1977, Astron. Astrophysics 56
New theory of motion of the satellites of Mars from data of the Phobos space program. N M Ivanov, Yu F Kolyuka, S M Kudryavtsev, et al 1990, Dokl. Akad. Nauk USSR 313
The ESO/Uppsala Survey of The ESO(B) Atlas (A. Lauberts 1982)
Smithsonian Astrophysical Observatory Star Catalog (SAO, version 1990)
The Revised New General Catalogue of Nonstellar Astronomical Objects (RNGC)
Bright Star Catalogue, 5th Revised Edition, Preliminary Version
A Catalogue of Constellation Boundary Data
A New Optical Catalog of Quasi-Stellar Objects (Hewitt and Burbidge 1989)
Asteroids II machine-readable data base: March 1988 version
Catalogue of Open Cluster Data, 5th edition, February 1987
Merged Catalogue of Galaxies (Kogoshvili, 1986)
The Catalogue of H II Regions
The Lynds' Catalogue of Bright Nebulae
The Lynds' Catalogue of Dark Nebulae
The Strasbourg Catalogue of Galactic Planetary Nebulae (Acker, Marcout, and Ochsenbein, 1980)
Seidelmann P.K., ed. Explanatory supplement to the Astronomical Almanac – University Science Books, 1992.
Astronomical Almanac for the year 1993 – U.S.Naval Observatory, Royal Greenwich Observatory, 1992.
Davies, M.E. et al. (1980) Report of the IAU Working Group on cartographic coordinates and rotational elements of the planets and satellites. – Cel. Mech., 22, 205-230.
Newhall, X.X, Standish, E.M., and Williams, J.G. (1983). DE102: a numerically integrated ephemeris of the Moon and planets spanning forty-four centuries – Astron. Astrophys., 125, 150-167.
Standish, E.M. (1982) Orientation of the JPL ephemerides, DE200/LE200, to the dynamical equinox of J2000 – Astron. Astrophys., 114, 297-302.
Bretagnon P. (1982) Theorie du mouvement de l'ensemble des planetes. Soultion VSOP82 – Astron. Astrophys., 114, 278-288.
Bretagnon P., Simon J.-L. Planetary programs and tables from -4000 to +2800 – Willmann-Bell, Inc., 1986.
Taylor, D.B. and Shen, K.X. (1988) Analysis of astrometric observations from 1967 to 1983 of the major satellites of Saturn – Astron. Astrophys., 200, 269-278.
Laskar, J. and Jacobson, R.A. (1987) An analytical ephemeris of the Uranian satellites – Astron. Astrophys., 188, 212-224.
Belyaev N.A. et al. Catalogue of short-period comets – Astronomical Institute of the Slovak Academy of Sciences, Bratislava, 1986
Video of Moon landings, Moon Roving Vehicle and Venus surface by courtesy of NASA
Spacecraft orbits courtesy of Space Flight Data Applications.
Formation of the Moon simulation courtesy of Smithsonian Astrophysical Observatory
Professor Jay Pasachoff

Trademarks

MS-DOS is a registered trademark of Microsoft Corporation. Windows is a trademark of Microsoft Corporation.IBM is a registered trademark of International Business Machines Corporation.
Macintosh is a registered trademark of Apple Computer, Inc. Power Macintosh, QuickTime and the QuickTime Logo are trademarks of Apple Computer, Inc. used under license.

SOFTWARE LICENSE

PLEASE READ THIS LICENSE CAREFULLY BEFORE USING THE SOFTWARE. BY USING THE SOFTWARE, YOU ARE AGREEING TO BE BOUND BY THE TERMS OF THIS LICENSE. IF YOU DO NOT AGREE TO THE TERMS OF THIS LICENSE, PROMPTLY RETURN THE UNUSED SOFTWARE TO THE PLACE WHERE YOU OBTAINED IT AND YOUR MONEY WILL BE REFUNDED.

1. License

The application, software and data accompanying this license, whether on CD-ROM, diskette or any other media (the Software) and the related documentation are licensed to you by Maris Multimedia Ltd (Maris). You own the media on which the Software is recorded but Maris and its Licensors retain title to the Software and related documentation. This License allows you to use the Software on a single computer only. You may also transfer all your license rights in the Software and the related documentation to another party, provided the other party reads and agrees to accept the terms and conditions of this license.

2. Restrictions

The Software contains copyrighted material, trade secrets and other proprietary material. In order to protect them, and except as permitted by applicable legislation, you may not decompile, reverse engineer, disassemble or otherwise reduce the Software to a human perceivable form. You may not modify, network, rent, lease, loan, distribute or create derivative works based upon the Software in whole or in part. You may not electronically transmit the Software from one computer to another or over a network.

3. Termination

This License is effective until terminated. You may terminate this License at any time by destroying the Software, related documentation and all copies thereof. This license will terminate immediately without notice from Maris if you fail to comply with any provision of this license. Upon termination, you must destroy the Software, related documentation and all copies thereof.

4. Export Law Assurances

You agree and certify that neither QuickTime (a copy of which is supplied with the software), nor the direct product thereof, will be exported outside the United States except as authorised and as permitted by the laws and regulations of the United States. If QuickTime has been rightfully obtained by you outside of the United States, you agree that you will not re-export QuickTime, nor the direct product thereof, except as permitted by the laws and regulations of the United States and the laws and regulations of the jurisdiction in which you obtained the Software.

5. Limited Warranty on Media

Maris warrants the diskettes and/or CD-ROM on which the Software is recorded to be free from defects in materials and workmanship under normal use for a period of ninety (90) days from the date of purchase as evidenced by a copy of the receipt. Maris' entire liability and your exclusive remedy will be replacement of the diskettes and/or CD-ROM not meeting Maris' limited warranty and which is returned to Maris or an authorised representative with a copy of the receipt. Maris will have no responsibility to replace a diskette and/or CD-ROM damaged by accident, abuse or misapplication. ANY IMPLIED WARRANTIES ON THE DISKETTES AND/OR CD-ROM, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO NINETY (90) DAYS FROM THE DATE OF DELIVERY. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY BY JURISDICTION.

6. Disclaimer of Warranty

You expressly acknowledge and agree that use of the Software is at your sole risk. The Software and related documentation are provided "AS IS" and without warranty of any kind and Maris and Maris' Licensors (for the purposes of provisions 7 and 8, Maris and Maris' Licensors shall be collectively referred to as "Maris") EXPRESSLY DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. MARIS DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE SOFTWARE WILL MEET YOUR REQUIREMENT, OR THAT THE OPERATION OF THE SOFTWARE WILL BE UNINTERRUPTED OR ERROR-FREE, OR THAT DEFECTS IN THE SOFTWARE WILL BE CORRECTED. FURTHERMORE, MARIS DOES NOT WARRANT OR MAKE ANY REPRESENTATIONS REGARDING THE USE OR THE RESULTS OF THE USE OF THE SOFTWARE OR RELATED DOCUMENTATION IN TERMS OF THEIR CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY MARIS OR AN AUTHORISED REPRESENTATIVE SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY. SHOULD THE SOFTWARE PROVE DEFECTIVE, YOU (AND NOT MARIS OR AN AUTHORISED REPRESENTATIVE) ASSUME THE ENTIRE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU.

7. Limitation of Liability

UNDER NO CIRCUMSTANCES INCLUDING NEGLIGENCE, SHALL MARIS BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES THAT RESULT FROM THE USE OR INABILITY TO USE THE SOFTWARE OR RELATED DOCUMENTATION, EVEN IF MARIS OR AN AUTHORISED REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SOME JURISDICTIONS DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

In no event shall Maris' total liability to you for all damages, losses, and causes of action (whether in contract, tort (including negligence) or otherwise) exceed the amount paid by you for the Software.

8. Controlling Law and Severability

This License shall be governed by and construed in accordance with English law. If for any reason a court of competent jurisdiction finds any provision of this License, or portion thereof, to be unenforcable, that provision of the License shall be enforced to the maximum extent permissible so as to effect the intent of the parties, and the remainder of this License shall continue in full force and effect.

9. Complete Agreement

This License constitutes the entire agreement between the parties with respect to the use of the Software and the related documentation, and supersedes all prior or contemporaneous understanding or agreements, written or oral, regarding such subject matter. No amendment to or modification of this License will be binding unless in writing and signed by a duly authorised representative of Maris.

TABLE OF CONTENTS

Minimum system requirements....2
Absolute beginners....3
What's new in RedShift 2....4
Visual Guide
- Operating RedShift 2....5
- Exploring the sky....7
- Working with Time....17
- Working with Location....19
- Working with Direction....25
- Planets and Moons
  - Move Around Planet....31
  - Follow Planet....33
  - Center on Planet....35
- Maps....39
- Dictionary of Astronomy....41
- Guided Tours & Tutorials....43
- Photo Gallery & Movie Gallery....45
- Movie Recorder....47
- Events
  - Space Flight....23
  - Conjunction Finder....49
  - Eclipse Finder....50
- Visibility Reports....51
- Preferences....55
- Printing....56
- Saving and Restoring Views....57

RedShift 2 Settings....59
Appendix
- Planets, Moons and Stars....63
- Accuracy of Positions....64

Index....65

MINIMUM SYSTEM REQUIREMENTS

For Windows
IBM compatible 386SX processor or better
Windows 95 or Windows 3.1/ 3.11 and MS-DOS 3.3 or above
8 Megabytes of RAM
CD-ROM drive & MSCDEX 2.0 or later
256 color VGA display
Windows compatible Sound card
Mouse

Recommended system
IBM compatible 486 processor
8 megabytes of RAM
double speed CD-ROM drive
2 megabytes of hard disk space
256 color display (64k/16 bit color)
800 x 600 with small fonts

For Macintosh
Macintosh LC II running System 7.0 or above
8 megabytes of RAM with 2.5MB free
CD-ROM drive
Color monitor (screens above 16" may require more memory)
QuickTime version 2.0 or above (supplied on the CD-ROM)

Recommended system
68040 based Macintosh running System 7.0 or above
5MB of free RAM
double speed CD-ROM drive
3 megabytes of hard disk space
Thousands of colors

For Power Macintosh
Power Macintosh 6100/60 running System 7.1.2 or above
8 megabytes of RAM
CD-ROM drive
Color monitor (screens above 16" may require more memory)
QuickTime version 2.0 or above and QuickTime PowerPlug (supplied on the CD-ROM)

Recommended system
double speed CD ROM drive
3 megabytes of hard disk space
Thousands of colors
QuickTime version 2.0 or above and QuickTime PowerPlug (supplied on the CD-ROM)

ABSOLUTE BEGINNERS

You don't have to be an astronomy expert to enjoy RedShift 2. Although RedShift operates to a high level of scientific accuracy, you can experience dramatic and realistic views of space using just a few simple controls.

- A good way to start using RedShift is to use the Guided Tours and Tutorials. 10 Guided Tours have been created to explain major astronomical themes or take you through the sequence of an astronomical event, accompanied by a commentary. They form a visual introduction to some of the basic concepts of astronomy. You can select Guided Tours instead of Main Program when you open RedShift. See page 43 to find out more.
- Once you have used Guided Tours, RedShift's tutorials will take you to a location and conjunction that show an exciting astronomical event, and the Instructions window offers you advice on how to use control panels and filters to bring out information in your view. For this reason, they are an excellent way of learning to use RedShift's sophisticated features. To access Tutorials, click on the button visible in the Guided Tours Gallery, or select **Information, Tutorials**... from within the main program. (Users upgrading from RedShift 1: please see a note about the terms 'tutorials' and 'guided tours' on pages 43-44.)
- Each of the planets and moons of the Solar System is available as a realistic 3D model. Use Motion Around Planet (in the Controls icon bar) to move around a planet. Drag the position sliders to view the planet from any direction. Several planets have moons (Jupiter and Saturn for example). Use the Planet Filter dialog to magnify the scale of a planet's moons (**Display, Planets...**). Then click the forward arrow in the Control Time panel to watch the moons orbit the planet.
- Use Follow planet (in the Controls icon bar) to track a planet as it orbits the Sun. Choose one of six directions to view the planet from, then click the forward arrow in the Control Time panel. All planets and moons are scalable so you can move closer or further away from them.

Because RedShift generates the positions of the stars and the planets mathematically, you can use it to generate an infinite number of views and events. We hope that you will gain much pleasure from using RedShift and that it will enhance your understanding of astronomy and the Universe.

- The Direction panel (in the Controls icon bar) provides an easy way to view different parts of the sky. Click the direction arrows to move your view around the sky. The and icons let you zoom your view in and out. Use the Filters panel to switch the constellations on and off.
- View breathtaking photographs of space from RedShift's extensive Photo Gallery (Information menu); click the button in the thumbnail picture to display a photograph full screen. Or browse the entries in the online Dictionary of Astronomy (Information menu).
- The Visual Guide on the following pages provides a quick and simple way of getting to know RedShift. Follow the Visual Guide and try out the controls. Don't worry if you get lost in space; you can reset RedShift back to its default view at any time by selecting Default Settings from the Controls menu.

WHAT'S NEW IN REDSHIFT 2

Welcome to RedShift 2. Users of RedShift 1 will find many features that make RedShift easier to use, as well as more information, updated and improved photos and pictures, and a new location from which they can observe the Solar System.

The main additions are:

Information

- The all-new Guided Tours feature (not to be confused with the Guided Tours in RedShift 1) gives exciting animated introductions to major concepts and events in astronomy. Dr. Jacqueline Mitton has specially scripted these tours, which are narrated by Hannah Gordon;
- you can now locate your position on a comet, asteroid or space vehicle and travel round the Solar System, experience dramatic views of Earth and other planets;
- you can now display all stars within a selected magnitude, regardless of zoom factor, giving beautiful views of the entire sky;
- many photos have been updated; new video sequences have been added;
- and a full surface map of Venus has been added to those of the Earth, Moon and Mars.

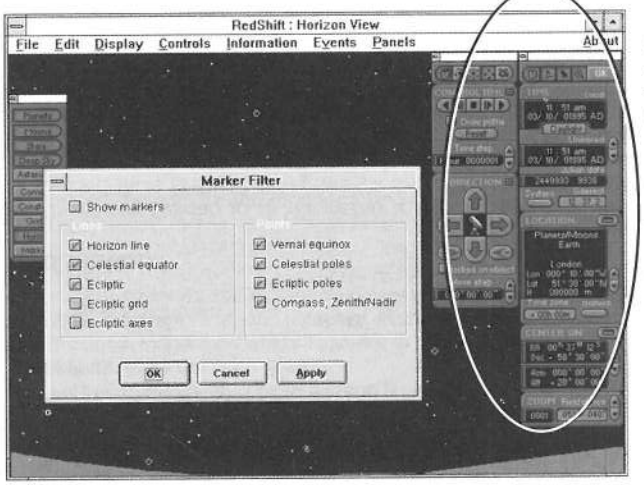
Ease of Use

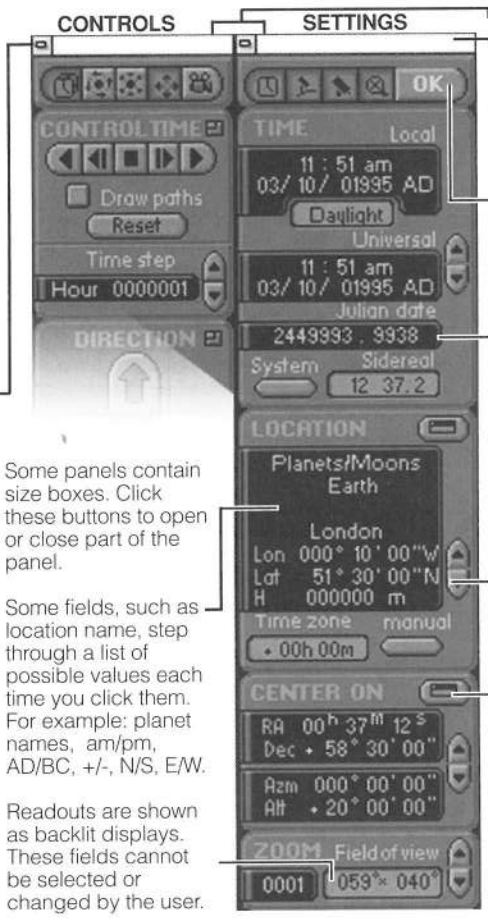
- The Object Filters Group Dialog box makes it easier to change settings for stars, deep sky, asteroids, comets, planets and moons;
- you can display the ecliptic grid and axes, which give you a clearer idea of your position relative to the Sun;
- many other minor changes will be appreciated by RedShift users.

OPERATING REDSHIFT 2

RedShift 2 is operated using a combination of menus, dialog boxes and control panels. Dialog boxes are opened from menus. In certain cases, dialog boxes can also be opened by clicking the ▭ button on control panels.

The control panels have been designed to remain open while you are using the software. There are 11 individual control panels grouped under two icon bars: the Controls group and the Settings group. Panels can be opened and closed by clicking the buttons in the two icon bars. Close panels you are not using to see more of the sky.





Some panels contain size boxes. Click these buttons to open or close part of the panel.

Some fields, such as location name, step through a list of possible values each time you click them. For example: planet names, am/pm, AD/BC, +/-, N/S, E/W.

Readouts are shown as backlit displays. These fields cannot be selected or changed by the user.

Panels can be dragged to another part of the screen.

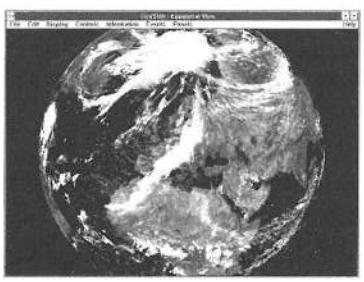
Icon bars and panels can be opened from the Panels menu.

The four Settings panels can be used individually, or together they work as an astronomical calculator. To apply new settings you must click *OK*.

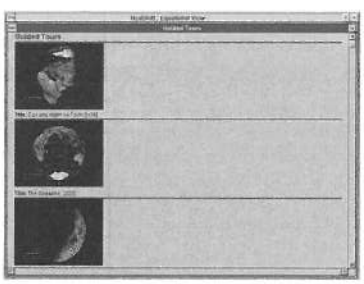
Click a field to select it. The contents of the field are highlighted in green when selected. You can also select each field in a panel in sequence by pressing the `Tab` key.

Enter new values or click and hold down on the arrow buttons to change values.

▭ buttons open dialog boxes. The same dialog boxes can be opened using the Find... commands in the Controls menu.

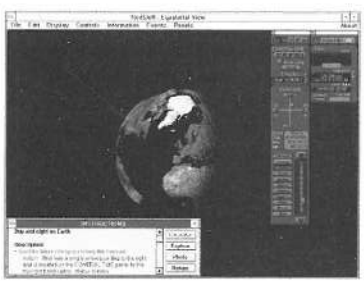


RedShift 2 places no upper limit on the size a planet image is displayed at. Large planet images take longer to change than small planet images. Remember, all the time RedShift is calculating the position of planets, the Sun and the stars. If at any time the screen goes black, you may be looking at the dark side of a planet. To check, turn phases off in the Planets dialog box (**Display, Object Filters, Planets...**).



RedShift features many tutorials. Click the (click me) button to start a tutorial. Open the Tutorials window by selecting **Information, Tutorials** ....

The Instructions panel tells you how to run the tour.



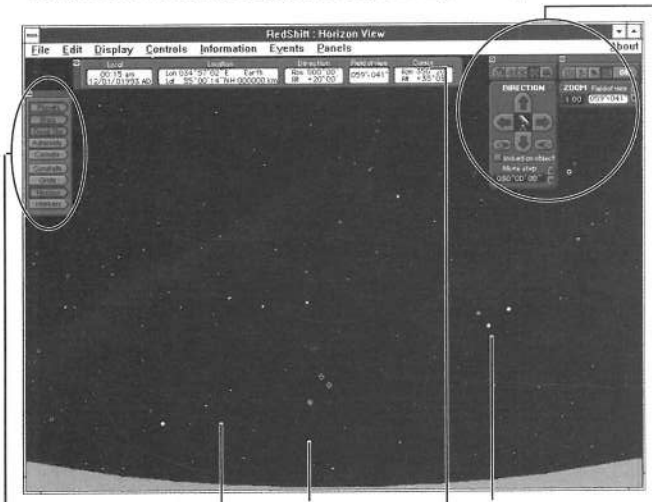
At the end of a tutorial, click *Return* on the Instructions panel to see more tutorials, or close the Instructions panel to continue using the software normally

To reset RedShift to its default settings after running a tutorial, select Default Settings from the Controls menu.

CONTROL PANEL ICONS	SETTINGS PANEL ICONS
CONTROL TIME	TIME
POSITION (Move Around Planet)	LOCATION
FOLLOW PLANET	CENTER ON
DIRECTION	ZOOM
MOVIE RECORDER	

EXPLORING THE SKY

RedShift 2 opens with a view of the sky above the local horizon of the Earth. Time is the current time set on your computer. On Windows computers the initial view is from London, England, looking directly North. On Macintosh computers the initial view is from the location set in the Map control panel, looking directly North.



Double click on any point to center on it.

Stars are shown as colored dots. Color denotes spectral properties of the star.

Galaxies and other deep sky objects outside of our galaxy are marked as blue symbols.

Planets are shown as colored dots when distant.

Clicking the four arrows on the Direction panel moves the direction of view by the number of degrees shown in the Move step.

Change the Move step value to increase or decrease the amount the arrows change the direction of view.

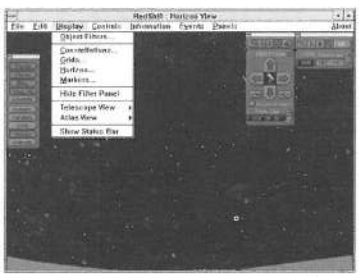
Click these buttons to increase or decrease the Zoom factor. The Zoom factor can also be changed using the + and - keys on the keyboard or by using the Zoom settings panel.

The Zoom Factor is changed by entering a new value. A value of 0.2 will display a complete celestial sphere.

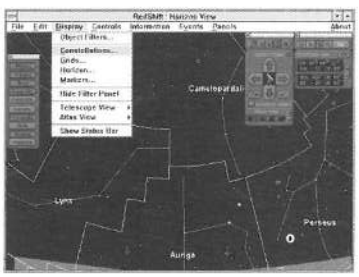
After entering values in the Settings panels, click *OK* or press `Return/Enter` to apply them.

The Status Panel gives information on your location, direction & time (select **Panels, Status**).

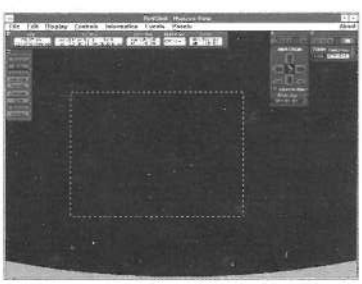
The Filter panel allows you to switch on and off the display of objects, constellations and grids (select **Panels, Filters**). You can also open the related dialog boxes by holding down `CTRL` (⌘ for Macintosh) when you click a Filter panel button.



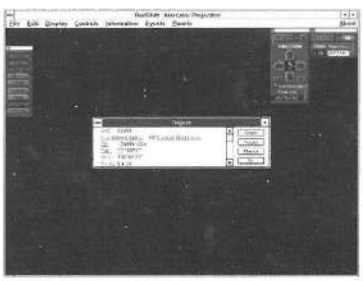
Use the Display menu to change views or projections. See page 30 for details.



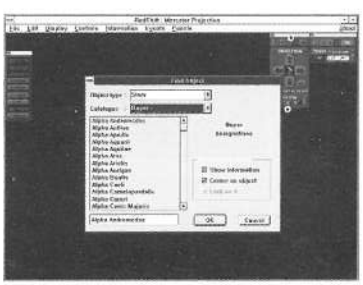
The Display options for objects, constellations and grids can be set through dialog boxes. These are accessed from the Display menu.



Drag a marquee (holding down the mouse button) to zoom in on an area of the sky. To zoom out, hold down `CTRL (option` for Macintosh) and drag a marquee. The marquee will have no effect if you are locked on an object.



Click on any object to display its name and technical data. The selected object is indicated. Click *Center* to center on the selected object, or Reports to get a visibility report (see page 51). Click *OK* to close the object window.



Find and center on any object using the Find Object dialog box (select **Controls, Find Object ...**). Select the type of object and type of name you want to search on. Search for an object by entering the first few letters of its name in the search field (see page 27 for more information).

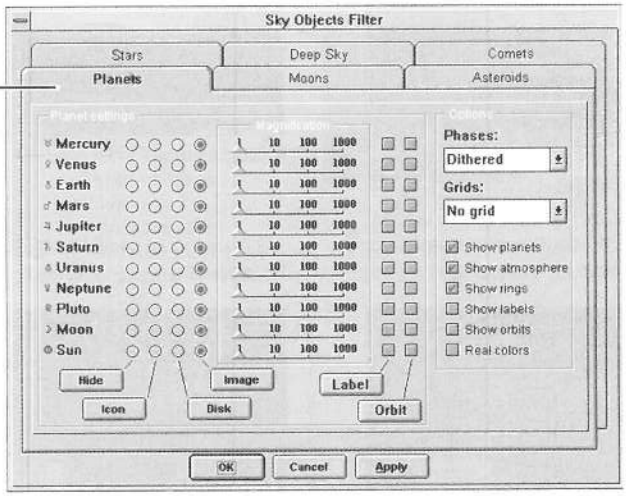
EXPLORING THE SKY - Object Filters Group dialog

RedShift 2 has filter dialog boxes that allow you to control the way you see objects in the sky such as planets, moons and stars - for example, you can choose whether you see moon orbits, what magnitude of stars will be visible in the sky, or what magnification will be used to show you the image of a particular planet. A related set of filter dialog boxes is grouped in the Display menu under Object Filters...

By altering the settings under this group dialog you can create a particular view of the astronomical event you are observing, which emphasises the information that interests you. You can control settings for Stars, Deep Sky, Asteroids, Comets, Planets and Moons.

To access the Object Filters Group dialog select Display, Object Filters... or CTRL+*any of the featured objects* **in the filter panel (eg.** CTRL+*Stars*, **etc; ⌘+*Stars* for Macintosh).**

To shift between the different kinds of object accessible in the group dialog, click on a tab to bring your chosen dialog to the front.



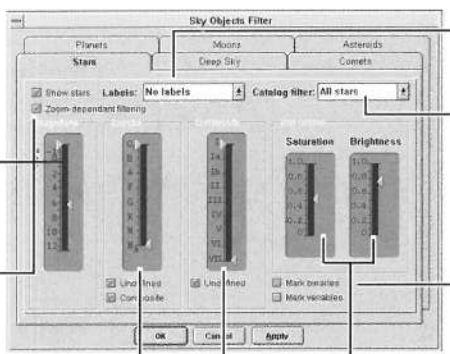
EXPLORING THE SKY - Star Filter dialog

The Star Filter dialog lets you control which stars are displayed and which you prefer to filter out. You can also switch star labels on or off, mark multiple star systems and variable stars.

To access the Star Filter dialog select Display, Object Filters... and click on the Stars tab, or CTRL+*Stars* **(⌘+*Stars* for Macintosh) in the Filters panel.**

Use the Magnitude slider to control the upper and lower magnitude limits for the stars to be displayed (the left hand triangle on the magnitude slider indicates the upper limit, the right triangle the lower limit). RedShift 2 is pre-set to display stars with magnitudes between -1.6 and 6.2 (dimmer stars have higher magnitude values). These are the stars visible to the naked eye.

To display all stars within the magnitudes and spectra you have selected, regardless of their distance from your observation point, switch off zoom-dependent filtering. This attractive new feature will greatly increase the number of stars on view. Note that you will find RedShift takes longer to redraw the screen, as it now has to calculate for all possible stars, rather than just those within your range of vision. It may be better to use this feature for fixed rather than moving views, depending on the speed of your computer.



To label stars select a star label type from the Labels pop-up menu. Note that not all stars have proper names.

To display only those stars from a specific star catalog, select a catalog name from the Catalog filter pop-up menu.

Click *Mark binaries* to mark binary and multiple stars (RedShift places b beside each binary and multiple star). Click *Mark variables* to mark variable stars (RedShift places v beside each variable star).

To alter the intensity and luminosity of artificial colours used to display the stars, adjust these sliders.

A star's spectral type can be used as a filter. For example you may wish to display only cool stars or only F-type stars. Use the Spectra slider to control the upper and lower spectral type limits (see table). A star's spectrum relates directly to its mass, temperature, brightness and age. Cool stars are shown red: hotter stars look bluish.

To distinguish whether a star is a giant, a dwarf, or lies on the main sequence, astronomers assign stars a luminosity class. Use the Luminosity slider to control the upper and lower luminosity class limits (see table).

Stellar Spectral Types			Stellar Luminosity Classes
Type	Color	Temp (C°)	I Very bright supergiants
			Ia Bright supergiants
M9 - M0	red	3000 - 3500	Ib Supergiants
K9 - K0	orange	3500 - 5000	II Bright giants
G9 - G0	yellowish	5000 - 6000	III Giants
F9 - F0	white	6000 - 7500	IV Subgiants
A9 - A0	bluish	7500 - 11000	v Main sequence
B9 - B0	blue	11000 - 25000	vI Subdwarfs
O9 - O0	blue	25000 - 40000	vII White dwarfs

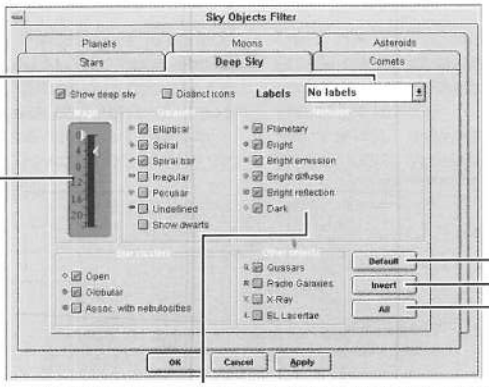
EXPLORING THE SKY - Deep Sky Filter dialog

RedShift 2 lets you view over 40,000 deep space objects (these are more commonly referred to as deep sky objects and are shown as light blue symbols). Deep sky objects are mostly those located outside our Galaxy. The Deep Sky Filter dialog lets you control which deep sky objects are displayed.

To access the Deep Sky Filter dialog select Display, Object Filters... and click on the Deep Sky tab, or CTRL+*Deep Sky* **(⌘+*Deep Sky* for Macintosh) in the Filters panel.**

To label deep sky objects select a label type from the Labels pop-up menu. Note that not all deep sky objects have proper names.

Use the Magnitude slider to control the upper and lower magnitude limits for the deep sky objects to be displayed (the left hand triangle on the magnitude slider indicates the upper limit, the right triangle the lower limit). RedShift is pre-set to display deep sky objects with magnitudes between 0 and 6.2 (dimmer deep sky objects have higher magnitude values). These are the deep sky objects visible to the naked eye.



Click *Default* to reset the deep sky filter to its pre-set settings

Click *Invert* to switch selected object types off and show all object types not currently selected.

Click *All* to switch all object types on.

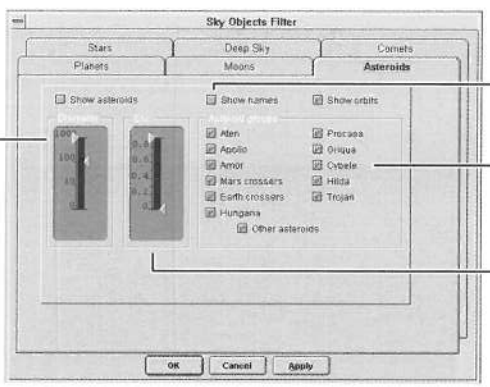
Click the various deep sky object type buttons to switch the display of deep sky objects on and off. The symbols used by RedShift are shown beside each button.

EXPLORING THE SKY - Asteroid Filter dialog & Comet Filter dialog

RedShift 2 lets you view 5,011 asteroids. Asteroids (also known as minor planets) are shown as pink dots. If all the asteroids are displayed this will slow down the speed at which RedShift operates.

To access the Asteroid Filter dialog select Display, Object Filters... and click on the Asteroid tab, or CTRL+*Asteroids* **(⌘+*Asteroids* for Macintosh) in the Filter panel.**

Although the biggest known asteroid Ceres is 911 km in diameter, most asteroids are very small. Use the Diameter slider to control the upper and lower diameter limits of the asteroids to be displayed (the left hand triangle on the Diameter slider indicates the upper limit, the right hand triangle the lower limit). RedShift is pre-set to display asteroids with diameters between 1000 and 100 kilometers.



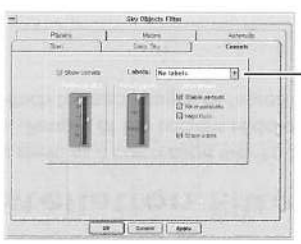
To label asteroids with their name or number click *Show names*.

Click the various asteroids group buttons to switch the display of asteroids groups on and off.

Another important characteristic of an asteroid is its eccentricity. Use the Eccentricity slider to control the upper and lower eccentricity limits of the asteroids to be displayed.

RedShift lets you view almost one hundred short-period comets. Comets are shown as blue dots.

To access the Comet Filter dialog select Display, Sky Objects... and click on the Comet tab, or CTRL+*Comets* **(⌘+*Comets* for Macintosh) in the Filter panel.**



To label comets select a label type from the Labels pop-up menu. Note that not all comets have proper names.

EXPLORING THE SKY - Constellation Filter dialog

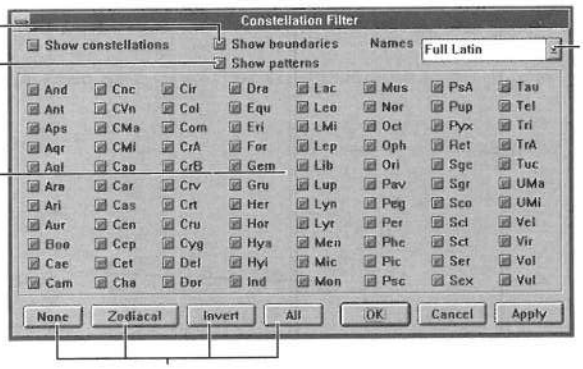
The sky is divided into 88 constellations. Astronomers use them as a convenient way to locate and name celestial objects. The boundary of each constellation forms an irregular polygon. People of the ancient Middle East believed that when they connected the brightest stars of a constellation they could see patterns which formed images of fabled creatures. These gave the names to the original 12 constellations of the Zodiac.

To access the Constellations Filter dialog select Display, Constellations... or CTRL+*Constells* (⌘+*Constells* **for Macintosh) in the Filter panel.**

Click *Show boundaries* to display constellation outlines.

Click *Show patterns* to display constellation patterns.

Click constellation names to switch individual constellations on and off.


Constellation Filter
Show constellations
Show boundaries
Show patterns
Names
Full Latin
And Cnc Cir Dra Lac Mus PsA Tau
Ant CVn Col Equ Leo Nor Pup Tel
Aps CMa Com Eri LMi Oct Pyx Tri
Aqr CMi CrA For Lep Oph Ret TrA
Aql Cap CrB Gem Lib Ori Sge Tuc
Ara Car Crv Gru Lup Pav Sgr UMa
Ari Cas Crt Her Lyn Peg Sco UMi
Aur Cen Cru Hor Lyr Per Scl Vel
Boo Cep Cyg Hya Men Phe Sct Vir
Cae Cet Del Hyi Mic Pic Ser Vol
Cam Cha Dor Ind Mon Psc Sex Vul
None
Zodiacal
Invert
All
OK
Cancel
Apply

To change the way constellation names are displayed choose a type of name from the Names pop-up menu. RedShift 2 defaults to showing full Latin names.

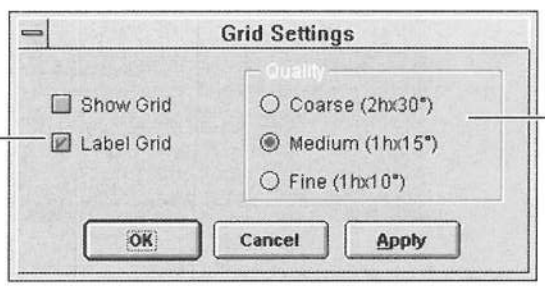
Click *None, Zodiacal, Invert* or *All* to switch selected constellations on and off quickly. *Zodiacal* displays only the 12 constellations of the zodiac. *Invert* switches selected constellations off and displays all constellations not currently selected.

EXPLORING THE SKY - Grid Filter dialog

RedShift 2 lets you display equatorial grids.

To access the Grid Filter dialog select Display, Grids... or CTRL+*Grids* (⌘+*Grids* **for Macintosh) in the Filter panel.**

To label grid parallels and meridians, click Label Grid



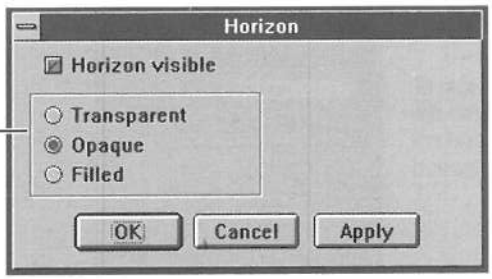
To select distances between meridians and parallels, click *Coarse, Medium or Fine.*

EXPLORING THE SKY - Horizon Filter dialog

The Horizon Filter dialog lets you control how the horizon is displayed. Note that a horizon can only be visible when using Horizon view.

To access the Horizon Filter dialog select Display, Horizon... or CTRL+*Horizon* (⌘+*Horizon* **for Macintosh) in the Filter panel.**

Click *Transparent* to show the horizon as a line. Click *Opaque* to shade the area below the horizon; all celestial objects below the horizon continue to be visible. Click Filled to fill the area below the horizon; celestial objects below the horizon are hidden. RedShift is pre-set to display an opaque horizon.

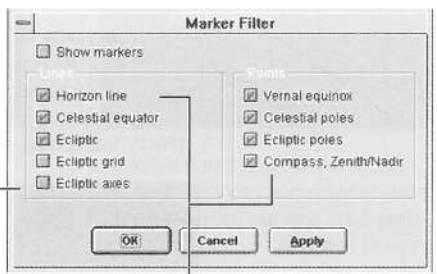


EXPLORING THE SKY - Marker Filter dialog

The Marker Filter dialog lets you control which lines and points are displayed.

To access the Marker Filter dialog select Display, Markers... or CTRL+*Markers* (⌘+*Markers* **for Macintosh) in the Filter panel.**

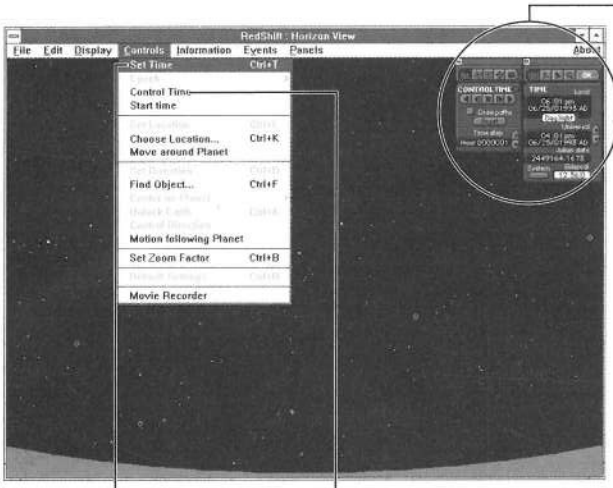
To display the ecliptic grid and axes, click the relevant box. Because the ecliptic shows the orbital plane swept out by the earth in relation to the sun, these lines can help clarify your position in the solar system.



Click *Horizon line, Celestial equator* or *Ecliptic* to display these lines. Click *Vernal equinox, Celestial poles, Ecliptic poles* or *Zenith/Nadir* to display these points. RedShift 2 is pre-set to show all lines and points when *Markers* is selected in the Filters panel.

WORKING WITH TIME

RedShift 2 lets you set the date and time anywhere between 4712 BC and 11,000 AD using the Time settings panel. Time can be made to run faster using the Control Time panel. This is useful when simulating astronomical events which may take hours or years to happen.



To enter a new time and date, select Set Time from the Controls menu or click the button in the Settings icon bar.

To run time faster, select Control Time from the Controls menu, or click the button in the Controls icon bar.

Runs time backwards or forwards in current steps (time tracking).

After tracking time, clicking *Reset* resets the time and date in the Time settings panel to its previous value.

Time at Greenwich Meridian with no daylight saving (GMT).

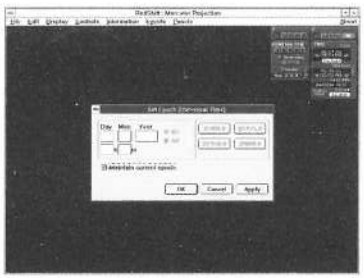
Astronomical units of time (see the Dictionary of Astronomy).

Click to reset time to the current time set on your computer.

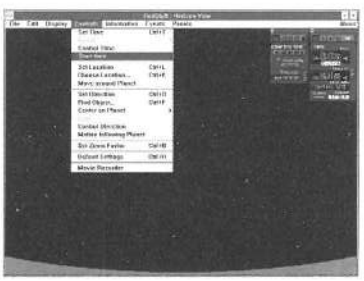
Local time on Earth. Change to simulate astronomical events. Date can be set between 4712 BC and 11,000 AD.

Change from European to US date format using Preferences

Local time cannot be set when your location is not on Earth.



Normally RedShift 2 automatically adjusts the epoch to that of the time set in the Time Settings panel so as to allow for the effects of precession. In some circumstances you may wish to set a different epoch. To do this, use the Epoch dialog (**Controls, Epoch...**). The epoch can only be changed when displaying a Mercator or Polar projection.



RedShift can calculate the actual motion of planets and other objects as each minute passes. Start real time by selecting Start Time from the Controls menu. will flash in the Time Settings panel while real time is running. Select Stop Time from the Controls menu to stop real time.

The Time settings panel (and the Location and Center On panels) are locked while time tracking is operating.

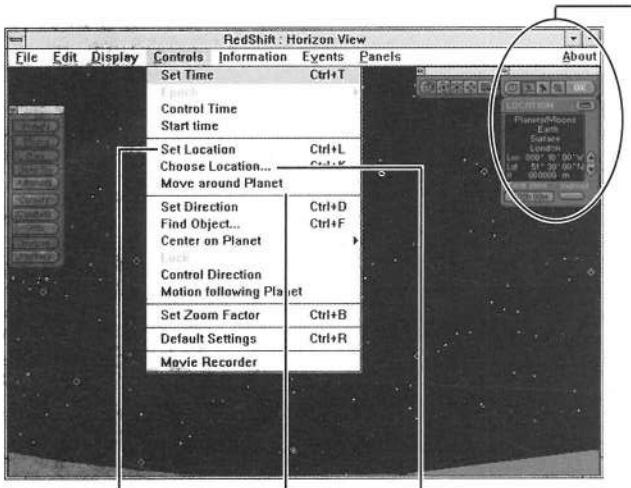
To stop time tracking, click in the Control Time panel .

For each 15° west of Greenwich, local time lags behind Universal Time by one hour. As local time is known, Universal Time can be calculated from it by reference to the longitude currently set in the Location Settings panel. RedShift does this automatically, and shows the calculated offset in the Time zone field (Location panel). Because of local variations in daylight saving (and adjustments which are sometimes made to standardise time within civil boundaries) it may be necessary to over-ride this automatic calculation by changing the value in the Time zone field.

1. If the Time zone field is set to automatic (i.e. it is backlit) click manual before trying to enter a new value.
2. Enter the number of hours difference between local time at your chosen location, and Universal time (GMT). This will change local time, while keeping Universal time constant.
3. Now enter the correct local time for your chosen location in the Location Settings panel and click *OK*. Universal time will be set correctly.

WORKING WITH LOCATION

RedShift 2 lets you set your location anywhere on Earth or any other planet or moon. You can also choose a heliocentric location: that is anywhere in space within the Solar System. RedShift also allows you to set your location on a comet or asteroid.



To set location, choose Set Location from the Controls menu or click the button in the Settings icon bar.

To find and set a named location on Earth, Moon or Mars use Choose Location from the Controls menu.

To set position around a planet or moon choose Move around Planet from the Controls menu or click the button in the Controls icon bar. See Move around Planet (page 31) for more information.

Click to cycle through Planets/Moons, Comets, Asteroids and Heliocentric locations.

The name of the location is indicated here.

Enter height. When your location is set on a planet or moon, height can be entered in meters. With heliocentric location, distance is measured in astronomical units (a.u) from the Sun. Changing location to another planet or moon helps you observe nearby objects in close-up.

Heliocentric location lets you observe from anywhere in space within 100 astronomical units of the Sun.

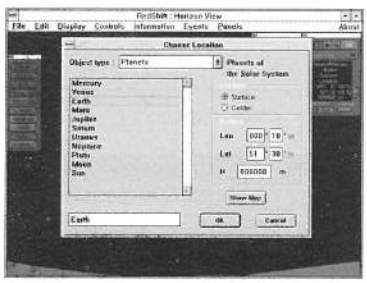
When your location is set on Earth, RedShift calculates the difference in hours, between your local time and Universal time. See Working with Time (page 17) for an explanation of the effects of daylight saving.

Click *OK* or press Return/Enter to apply your new location settings.

Click to open the Find Location dialog.

For Planets/Moons, you can choose whether to be located on the surface of the object, or to observe from the co-ordinates of its center.

Click on a value first to select it, then use the up and down arrows to change the height or longitudinal or latitudinal measurements.



Use Choose Location to enter a new longitude and latitude on any planet, moon, comet, asteroid - or a heliocentric location (position in relation to the Sun). Click *W* or *E* to the right of the longitude field to change between West and East longitudes. Click *N* or *S* to the right of the latitude field to change between North and South latitudes. You can also specify your height above the object's surface. For Earth, Moon, Mars or Venus, the *Show Map* button will be available: click on this button to show the Planet Map dialog for working with surface maps and gazetteers of these planets; this dialog is explained overleaf.

RedShift 2 allows you to locate your position on asteroids or comets. Select *asteroids* or *comets* from the pop-up menu, then choose your location from the list (objects with well-known names come after the numbers at the top).

If a planet has a moon, ▶ appears to the left of the location name field. To set your location to one of the planet's moons click ▶ and the location name field will now step through the planet's moons.

Set your location on a moon to get close-up views of its parent planet (or other moons).
Clicking ▼ will return you to stepping through planets.

The paths of comets and asteroids selected via the Choose Location dialog are calculated using RedShift's standard orbital mathematics. For minor objects such as comets, asteroids and spacecraft, this math is not accurate enough to model all the gravitational forces at work.

A special calculas has been developed for a limited number of objects which enables their orbits to be modelled ever more accurately. Choose **Events**, **Space Flight** (see page 23).

WORKING WITH LOCATION - Planet Map dialog

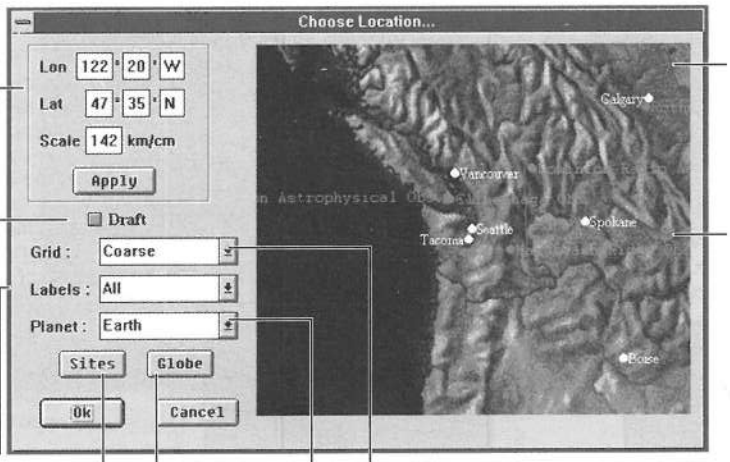
The Planet Map dialog lets you set your observing location to any point on the surface of the Earth, Moon or Mars. RedShift 2 lets you choose from a list of named sites, or enter longitude and latitude co-ordinates.

To access the Planet Map dialog select Controls, Choose Location, then choose your planet and press the Show Map button.

To set a new observing location on Earth, Moon, Mars or Venus enter the required values in the longitude and latitude fields. Click *W* or *E* to the right of the longitude field to change between West and East longitudes. Click *N* or *S* to the right of the latitude field to change between North and South latitudes. Click *Apply* to use the selected location for observing.

To move around the map more quickly set Draft option on (low resolution mode).

To display the names of towns and cities or observatories on the map use the Labels pop-up menu. If you have selected Moon, Mars or Venus you can display features or landing sites.

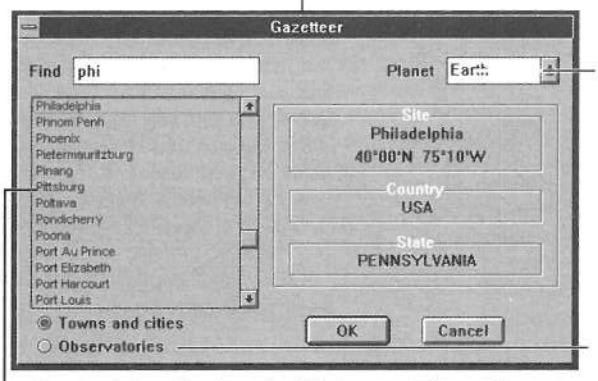


To set a new location on Earth, Moon, Mars or Venus double-click any point in the map window.

Zoom in on any area of the map by dragging a marquee (holding down the mouse button). To zoom out, hold down CTRL (option for Macintosh) and drag a marquee (when you release the mouse button the map will be re-drawn to fit an equivalent area of map in the map window). The map scale can also be changed by entering a new value in the Scale field. Switch between km/cm and miles/inch by clicking on the scale units to the right of the field.

To switch grids on and off, or choose between different types of grid, use the Grid pop-up menu.

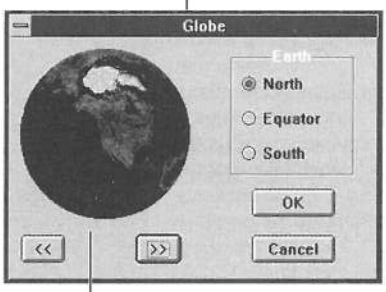
To change between Earth, Moon, Mars or Venus, use the Planet pop-up menu.



Use the pop-up menu to change between the Earth, Moon, Mars or Venus gazetteers.

To select a location from the list of named sites click *Sites*. The Gazetteer window will be displayed. Enter the first few letters of the site name in the Find field. The list will jump to the nearest alphabetic point in the gazetteer. Select a site name by clicking on it. Click *OK* to change observing location to the selected site. Note that additional information about the location is displayed to the right of the gazetteer list.

Click to switch between a list of towns & cities or observatories (features or landing sites if you have selected the Moon, Mars or Venus).



To move quickly to a new area of a planet, click *Globe*. The Globe window will be displayed. Use the arrows to spin the locator globe. Use the *North* and *South* buttons to view the globe from above and below. Move the yellow rectangle around the globe by moving the mouse. Click any point on the globe, then click *OK*, to move the map to the selected area. Note that the red cross indicates the point that the map will be centered on. The size of the yellow rectangle varies depending on the current scale of the map.

SPACE FLIGHT

Space Flight is a new feature of RedShift 2 that allows you to take a ride on a number of exceptionally interesting space objects, including Earth satellites, spacecraft, space probes, comets and asteroids. It employs detailed coordinate data and higher-level calculus to give a realistic account of each object's journey through space, recreating the influence of perturbing forces—especially the gravitational effects of nearby planets. You can either look at the object as it travels, or from it as an observation point.

Consult the special bonus leaflet about space flight included in your RedShift package. It lists detailed information about each object and experiments you can try.

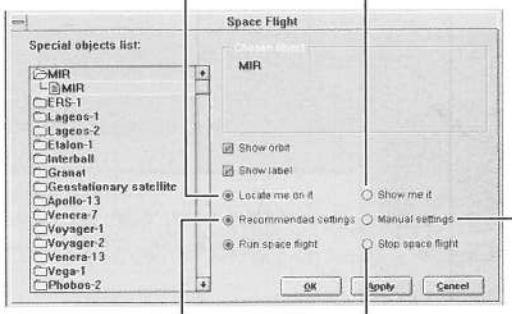
To enter space flight click the Space Flight button in the startup screen or choose Events, Space Flight...

Locate me on it is activated by default; this view uses the space flight object as your viewing platform.

Show me it gives a view of the object from a preset point in space.

The Space Flight dialog box gives you a list of folders that contain settings for different objects. Double-click a folder to open it, then click a setting to select it. Some objects have more than one settings file; when you start time running, their settings files play end to end so that you can travel through the Solar System with the object. You can of course stop time to observe planets at your leisure.

The dialog opens with buttons preset; if they are altered, next time you open the dialog in your RedShift session your choice will be shown and applied to further settings.



Recommended settings & controls for the object gives the most interesting combination of time, magnitude and appearance settings for the scene you survey with the object. When you first open the Space Flight dialog box, Recommended settings are selected by default.

When you choose *Manual settings*, RedShift establishes the location coordinates, time setting and calculus for the object, but no other parameters are reset.

To end your session click *Stop space flight session* (if you want to preserve your view but change to a new date, switching off the special calculus), or select **Controls, Default Settings...** (to start afresh).

When RedShift has implemented the default Recommended settings and redrawn the screen, start time running to enjoy the sequence. Within Recommended settings & controls you can alter all settings except date, time and time steps. If you switch to Manual settings you can adjust date and time steps. This allows you to conduct your own experiments with time, and build up viewing settings to follow your own interests. However, manual adjustment of date and time can sometimes result in very long calculations.

SPACE FLIGHT OBJECTS

Artificial objects orbiting Earth

Space Station:
Mir

Satellites:
ERS-1
Lageos-1
Lageos-2
Etalon
Interball
Granat
Geostationary Satellite

Earth missions to other planets

Manned Spacecraft:
Apollo 13

Space probes:
Venera-7
Venera-13
Voyager 1
Voyager 2
Vega-1
Phobos-2
Ulysses
Galileo

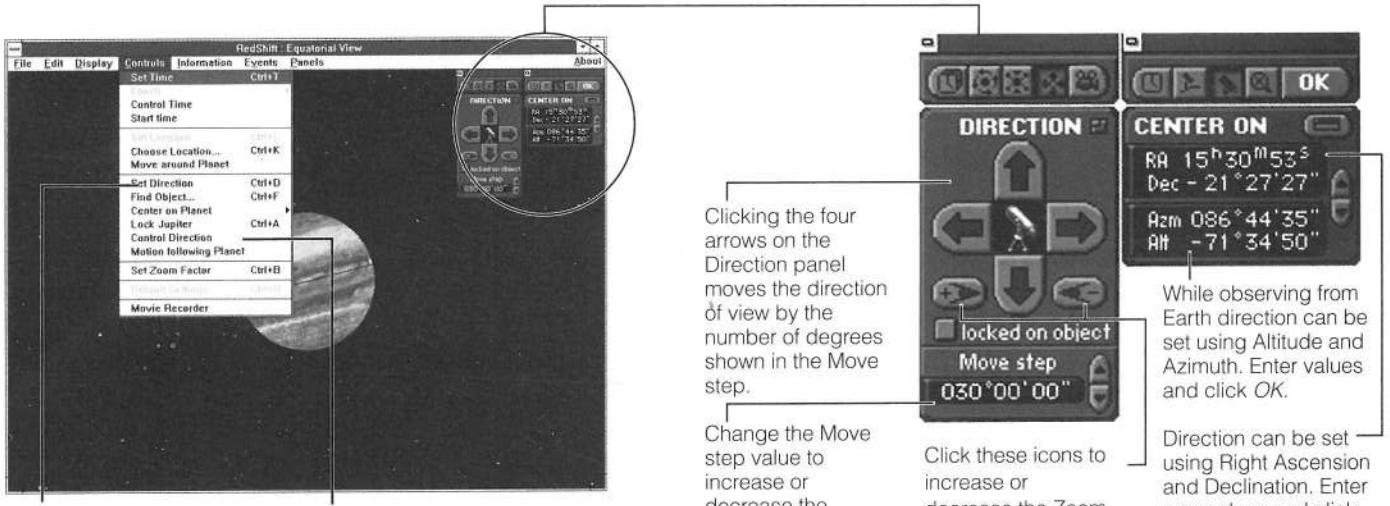
Natural objects

Asteroids and Comets:
Icarus
Toutatis
Hale-Bopp
Russel 1
Shoemaker-Levy 9

- RedShift space flight calculus does not take account of the facts that spacecraft land, and comets vaporize on impact with a planet—so an object that crashes or lands may appear to pass through a planet's center.
- If the Locate me on it button is dimmed in the Space Flight dialog box, you will need to close one or more of the Follow planet, Position, Zoom or Location panels before you can use it.
- If you want to locate yourself on a special object without resetting time, do so using Choose Location or the Location panel.
- If you alter the settings panels, the *OK* light glows red to show that you must click it to confirm changes.

WORKING WITH DIRECTION

RedShift 2 lets you center your view on any location or any object in space.



To display the Center On panel choose Set Direction from the Controls menu or click the button in the Settings icon bar.

To display the Control Direction panel choose Control Direction from the Controls menu or click the ✥ button in the Controls icon bar.

Clicking the four arrows on the Direction panel moves the direction of view by the number of degrees shown in the Move step.

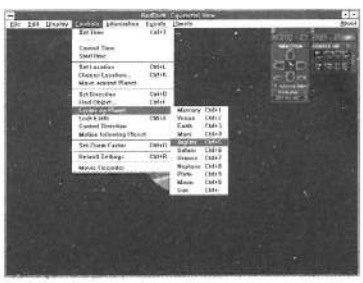
Change the Move step value to increase or decrease the amount the arrows change the direction of view.

Click these icons to increase or decrease the Zoom factor. The Zoom factor can also be changed using the + and - keys on the keyboard or by using the Zoom settings panel.

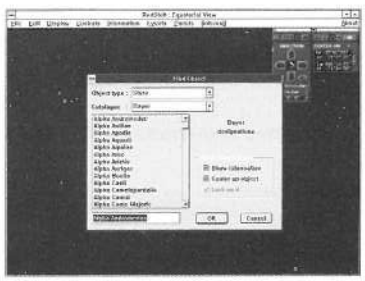
While observing from Earth direction can be set using Altitude and Azimuth. Enter values and click *OK*.

Direction can be set using Right Ascension and Declination. Enter new values and click *OK*.

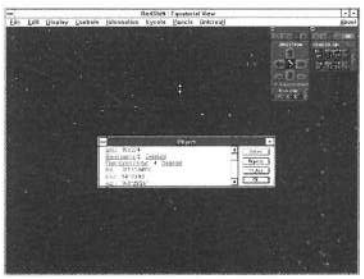
For an explanation of co-ordinate systems see the Dictionary of Astronomy.



To center on a planet choose Center on Planet from the Controls menu. See Center on Planet (page 35) for instructions.



Find and center on any object using the Find Object dialog (**Controls, Find Object...**). See Find Object dialog (page 27) for further explanation.



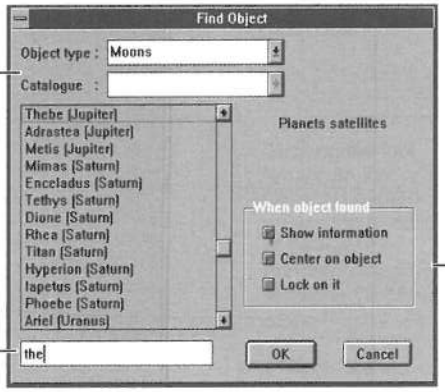
Click on any object to display its name and technical data. The selected object is indicated. Click *Center* to center on the selected object, or Reports to get a visibility report (see page 51). Click *Ephemerides* to get a location report (see page 29). Click *OK* to close the object window.

WORKING WITH DIRECTION - Find Object dialog

RedShift 2 lets you find any object in its catalogs of stars, asteroids, comets or deep sky objects, or to find any planet, moon or constellation. Using the Find Object dialog you can also choose whether to automatically center and lock on the object.

To access the Find Object dialog select Controls, Find object... or click ▭ on the Center On panel.

Choose the type of object you want to search for using the Object type pop-up menu. If you choose stars or deep sky objects you will also need to choose the type of name to search on.



Click to choose what you want RedShift to do when the selected object has been found.

Enter letters or numbers in the field at the bottom of the list of object names. The object names list will jump to the first name (or number) that starts with the letters you have entered. Click *OK* to find the selected object. Some of the object lists are very long (for example the SAO numbers list).

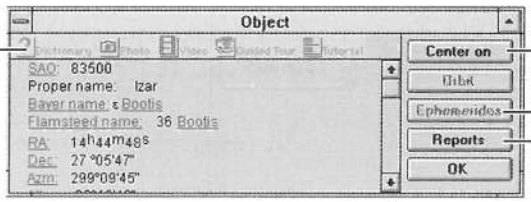
WORKING WITH DIRECTION - Object window

RedShift 2 lets you access detailed technical data about any object.

To access the Object window click on any object, or set Show information when using the Find Object dialog.

If media links are available (video, photos, guided tours or tutorials) they will be highlighted at the top of the dialog. Click to go to the media.

Underlined words or phrases are linked to the Dictionary of Astronomy. The cursor changes to ☝ when it is over a linked word. Click to display the entry in the Dictionary.



Click to center on the object.

Click to get an Ephemerides report - see page 29 for more information.

Click to get a visibility report - see Visibility Reports (page 51) for more information.

Scroll down to see additional information.

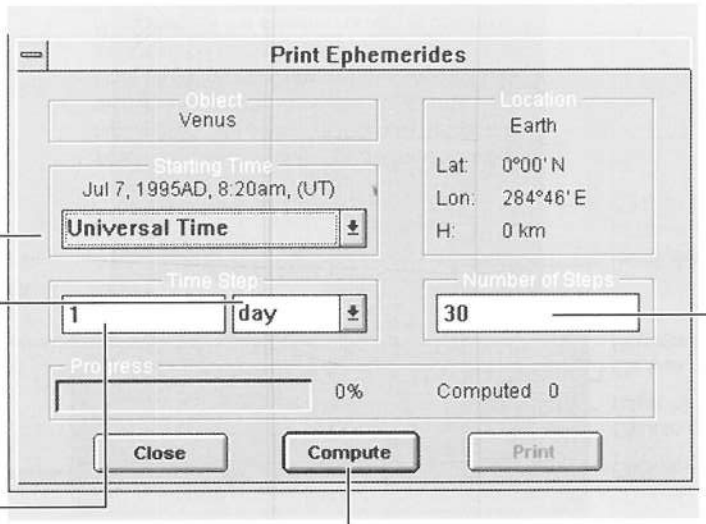
When the selected object is displayed it will be highlighted with arrows. If you have chosen to display information about the object, the Object window may obscure the object. Drag the Object window to see if the selected object is behind it. If the selected object is behind another larger object (for example a moon behind a planet) you will see the arrows marking the object's location, but not the object.

OBJECT WINDOW - EPHEMERIDES REPORTS

RedShift 2 can prepare and print reports on the celestial coordinates of any object; this is called a table of Ephemerides.

To access Ephemerides, click on the object, or set Show information when using the Find Object dialog; then click on Ephemerides.

The table will show the right ascension, declination, distance in astronomical units, azimuth and altitude for the object for a number of steps.



You can select Universal Time, Ephemeris Time, or local time; see the Dictionary of Astronomy for explanations.

The steps can be in minutes, hours, days or years.

The number of steps leapt at a time can be adjusted here.

RedShift will compute up to 999 steps in one calculation.

Press compute first, then print.

VIEWS AND PROJECTIONS

A computer screen is flat, so the methods of displaying the sky and sky objects on the screen necessarily involve methods of distortion. The views and projections aspects available on the Display menu allow you to make choices about these methods.

To select the different views and projections outlined below, select Display... then the chosen aspect.

Telescope views
These views show the sky as seen by an observer with the naked eye, or through a telescope.

Horizon view
This is the normal view seen by an observer standing on the planet's (or moon's) surface.

Equatorial view
This is the view with the horizon removed, and the main horizontal axis of the view aligned parallel to the Earth's equator.

Ecliptic view
This is the view with the horizon removed, and the main horizontal axis of the view aligned parallel to the plane of the ecliptic. Most of the planets lie in this plane.

Galactic view
This is the view with the horizon removed, and the main horizontal axis of the view aligned parallel to the galactic equator - i.e. the central plane of our galaxy. Most objects in our galaxy - e.g. star clusters - lie in this plane.

Atlas views
These views indicate methods of projection based on terrestrial geography. RedShift switches to one or another projection depending on which will provide the least distortion.

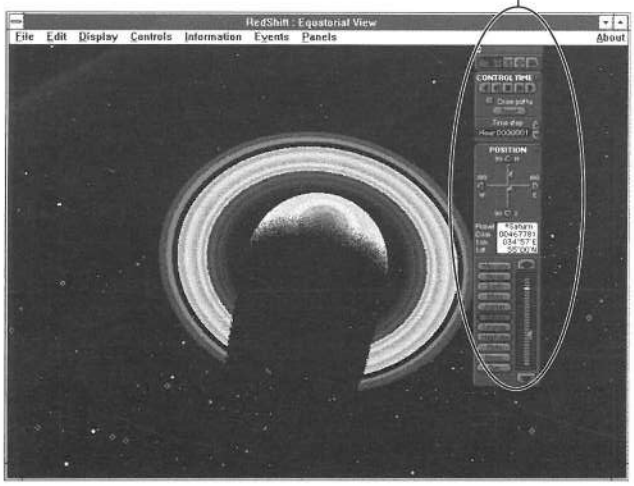
Mercator projection
This is a view of the sky as projected onto a cylinder whose center is the planet's equator.

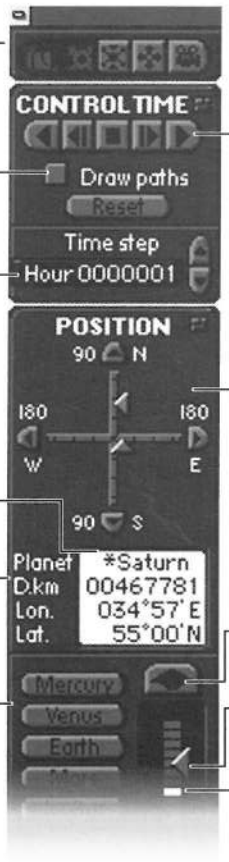
Polar projection
This a view of the sky as projected onto a sphere whose vertical axis is a pole.

Whether Mercator or polar projection is available depends on your declination, ie the angle of your telescope North or South of the planet's equator.

PLANETS AND MOONS 1 - Move around Planet

Move Around Planet allows you to select any planet, the Sun or the Moon, and move around in space to view it from any direction. You can also move closer or further away from the object.





Click to display a trail of symbols showing the orbit of planets.

Change units of time (minutes, hours, days, years) and the number of units for each time step.

An asterisk denotes a planet with moons.

Readout shows current longitude, latitude and distance from planet.

RedShift 2 can display and move around the surface of 11 objects in the solar system. Select a new object by clicking an object button.

Run time forwards or backwards to watch the object rotate.

Drag the pointers to change the longitude and latitude at the center of the planet image. The small arrows allow fine adjustment.

Arrows allow fine adjustment of distance.

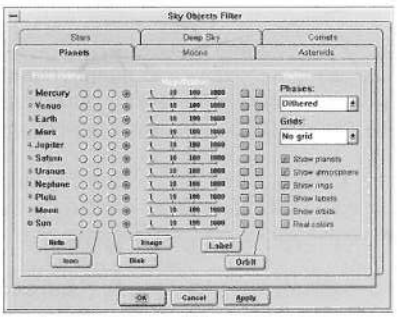
Drag pointer to change distance from the planet.

Blue bar indicates orbit of outermost moon.

To Move around Planet, select Move around Planet from the Controls menu, or click ⊕ in the controls icon bar.

Move around Planet is normally used in conjunction with the Control Time panel. See Working with Time (page 17) for instructions on controlling time.

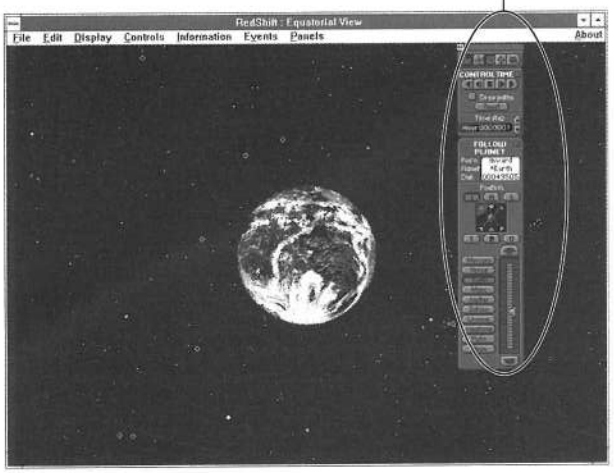
Close the Position panel to change your direction of view.



Use the Planets dialog (**Display, Object Filters, Planets...**) to switch phases, atmosphere and grids on and off. Use planet Magnification sliders to enlarge the scale of the planet image. See Planet Filter dialog (page 37) for further explanation.

PLANETS AND MOONS 2 - Follow Planet

Follow Planet lets you select any planet or the Moon, view it from any one of six fixed positions in space, then track the object as it moves through its orbit. You can also move closer or further away from the object.



Run time forwards or backwards to track the object's orbit.

Click to draw the orbital path of an object.

Change units of time (minutes, hours, days, years) and the number of units for each time step. Use longer time steps to track the object through its orbit.

An asterisk denotes a planet with moons.

Readout shows current position and distance from object.

Click one of the six position buttons to view the planet from a different direction.

- (I) Inward: between the Sun and the planet.
- (L) Leading: ahead of the planet with the Sun to your right.
- (A) Above: looking down on the northern hemisphere.
- (T) Trailing: behind the planet with the Sun to your left.
- (B) Below: looking up at the southern hemisphere.
- (O) Outward: with the planet between you and the sun (always in shadow unless phases switched off).

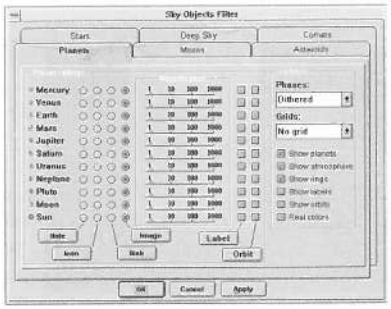
Drag pointer to change distance from the planet.

Follow planet displays and tracks the motion of 10 objects in the solar system. Select a new object by clicking an object button.

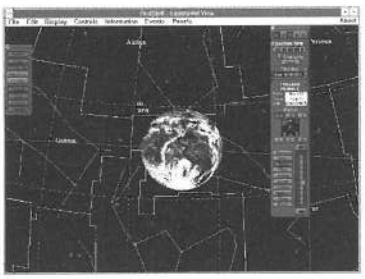
To Follow Planet, select Motion following Planet from the Controls menu, or click ✠ in the Controls icon bar.

Follow Planet should be used in conjunction with the Control Time panel. See Working with Time for instructions on controlling time.

Follow Planet initially locks your direction of view on the selected planet. Unlock to change direction of view (**Controls, Unlock...**).



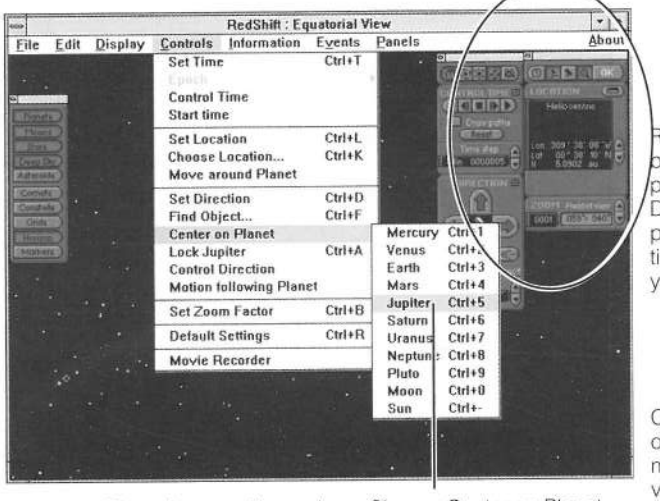
Use the Planets dialog (**Display, Object Filters, Planets...**) to switch phases, atmosphere and grids on and off. Use planet Magnification sliders to enlarge the scale of the planet image. See Planet Filter dialog (page 37) for further explanation.



Use the Filter panel (**Display, Show Filter Panel**) to switch constellations, grids and markers on when tracking the planet through its orbit.

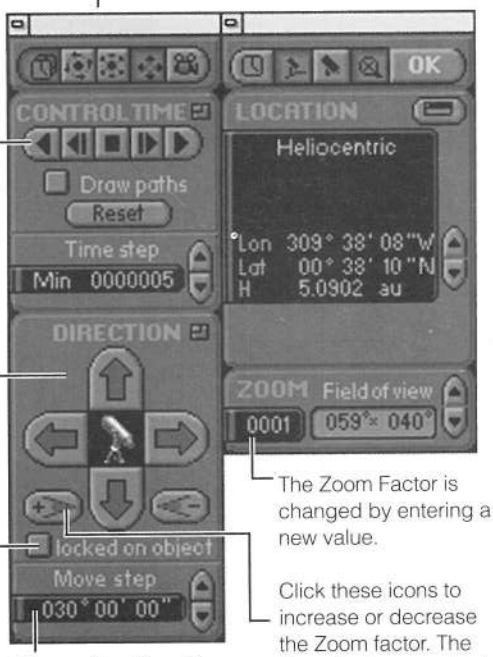
PLANETS AND MOONS 3 - Center on Planet

RedShift 2 lets you center your view on any planet, moon or the Sun. Set your location to a nearby planet or moon to get a close up view.



Center on Planet is normally used in conjunction with the Control Time panel. See Working with Time (page 17) for instructions on controlling time.

Choose Center on Planet from the Controls menu and pick a planet from the sub-menu.



Run time forwards or backwards to watch the planet rotate and orbit. Distance from the planet may vary over time, depending on your location.

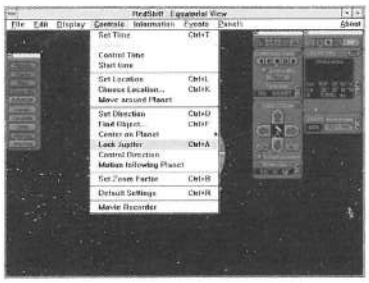
Clicking the four arrows on the Direction panel moves the direction of view by the number of degrees shown in the Move Step.

You cannot change your direction of view if you are locked on an object. A check mark here shows you are locked on an object. Click to unlock.

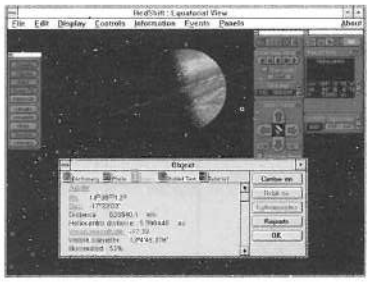
Change the Move Step value to increase or decrease the amount the arrows change the direction of view.

The Zoom Factor is changed by entering a new value.

Click these icons to increase or decrease the Zoom factor. The Zoom factor can also be changed using the + and - keys on the keyboard or by using the Zoom settings panel.



Once you have centered on a planet choose Lock (Control menu) before you run time, otherwise the planet will move out of view as it follows its orbit. You cannot change your direction of view while you are locked on an object.



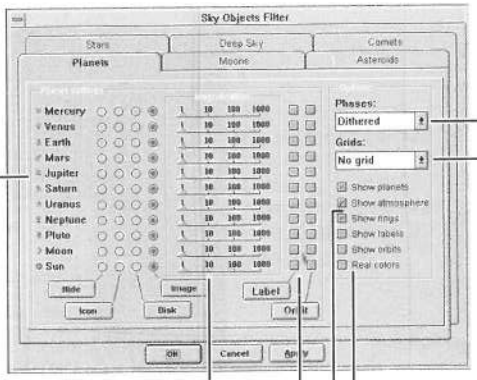
Use the Planet Filter dialog (**Display, Object Filters...**) to display poles and grids on planets, moons and the Sun.

Another way to center on a planet or moon is to click on the object to display an Object window. Then click *Center* in the object identification window. You can now lock the object as required.

PLANETS AND MOONS - Planet Filter dialog

RedShift 2 provides three-dimensional models for the nine known planets, their 35 most important satellites (moons) plus Earth's Moon and the Sun. Use the Planet Filter dialog to control how the planets and moons are displayed.

To access the Planet Filter dialog select Display, Object Filters... and click on the Planets tab, or CTRL+*Planets* **(⌘+*Planets* for Macintosh) in the Filters panel.**



RedShift is pre-set to display realistic images of planets and their satellites (moons). The surface of Mercury and many satellites have only ever been partially observed. Pluto and many of the smaller satellites display no detail even when observed through powerful telescopes. These planetary objects appear as discs rather than images. To display the image of a planet click the planet's radio button in the right-hand image column (or click the general *Image* button to display all planets and satellites as images).
To hide a planet click the planet's radio button in the left hand hide column (or click the general *Hide* button to hide all planets and satellites).
To display a planet as a symbol click the planet's radio button in the Icon column (or click the general *Icon* button to display all planets and Earth's Moon as symbols). Other satellites cannot be shown as icons. The icons used are shown beside planet names on the dialog box.
To display a planet as a disc click the planet's radio button in the Disc column (or click the general *Disc* button to display all planets and satellites as discs). Displaying planets and satellites as discs speeds up RedShift. If planets are shown as discs you are still able to view phases.

Use the Phases pop-up menu to switch phases (shadows) on and off, or switch to Sharp phases to see the exact edge of the shadow (terminator). RedShift is pre-set to use dithered phases. This gives planets and moons the most realistic appearance.

Use the Grids pop-up menu to switch planet surface grids on and off. When grids are switched on the prime (Greenwich) Meridian and the Equator are shown in red. The Poles only option marks the North and South poles of a planet.

Click buttons to select planet display options. Switching *Show atmosphere* off lets you view the surface of the Earth and Venus without cloud cover.

To override any sets of labels or orbits you have switched on for particular planets, use the Master buttons here. Until the Master buttons are switched on, you cannot affect individual planets' labels or orbits.

If *Show labels* is switched off, then your selected labels for planets are remembered by RedShift, but dimmed and not visible in the sky.

If *Show orbits* is switched off, then your selected orbits for planets are remembered by RedShift, but dimmed and not visible in the sky.

Use magnification sliders to enlarge individual planet or moon images. Enlarging moons can help when viewing them in orbit around their parent planet.

You can switch individual labels and orbits on and off with these buttons. Note that they can be overridden by the Master orbit/labels buttons.

RedShift can display both a planet's orbit as a solid line, and a label that tells you which planet you are looking at. You can select which planets' labels/orbits are displayed

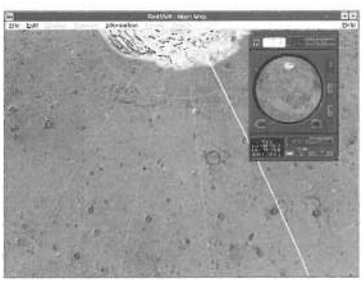
Planets	Period of rotation about axis	Period of rotation about Sun	Major Moons	Mean distance from planet (103km)	Period rotation about planet (days)
Mercury	59d	88d	Moon (earth)	384	27.3
Venus	243d	225d	Phobos (Mars)	9.4	0.3
Earth	24h	365d	Deimos (Mars)	23.5	1.3
Mars	25h	687d	Lo (Jupiter)	422	1.8
Jupiter	10h	12y	Europa (Jupiter)	671	3.6
Saturn	10h	29y	Ganymede (Jupiter)	1070	7.2
Uranus	17h	84y	Callisto (Jupiter)	1883	16.7
Neptune	16h	165y	Mimas (Saturn)	186	0.9
Pluto	6h	248y	Enceladus (Saturn)	238	1.4
			Tethys (Saturn)	295	1.9
			Dione (Saturn)	377	2.7
			Rhea (Saturn)	527	4.5
			Titan (Saturn)	1222	15.9
			Hyperion (Saturn)	1481	21.3
			Iapetus (Saturn)	3561	79.3
			Ariel (Uranus)	191	2.5
			Umbriel (Uranus)	266	4.1
			Titania (Uranus)	436	8.7
			Oberon (Uranus)	584	13.5
			Triton (Neptune)	354	5.9
			Nereid (Neptune)	5511	360.2
			Charon (pluto)	19	6.4

MAPS

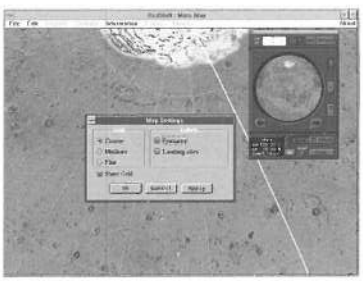
To view surface maps of the Earth, Moon, Mars or Venus select Maps from the Information Menu.

Double click on any point to center on it. Maps are large and very detailed. They may take some time to load and move on larger screens.

Click to change viewing location in main program.
Click to return to normal sky view
Lon 097°59'W
Lat 38°38'N
USE
RETURN
Click to display locator globe.
Click to input Lat/Long, Scale or choose option.
Center the yellow box on the area you wish to look at, click to re-center the map.
Click the arrow keys to rotate the globe.
N
S
Click to set Grid and Labels options.
Earth
Lon 097°59'W
Lat 38°38'N
Scale 1: 19.9 M
Grid
Labels
Draft
OK
Find...
Edit values to change longitude, latitude and scale. Click OK to apply.
Switch Grids on & off.
Opens Gazetteer.
Switch Labels on & off.
You may select Northern, Equatorial and Southern views.
Using draft quality speeds up map display.

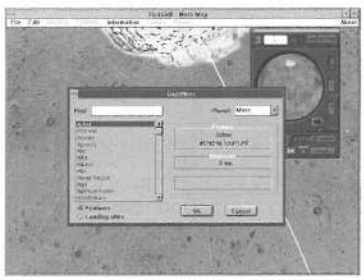


Switch to surface maps of the Moon, Mars or Venus by clicking the planet name field in the bottom panel section. Click *OK* or press `Enter` to confirm your choice.



Set Grid and Labels options by clicking the ▭ button in the bottom panel section.

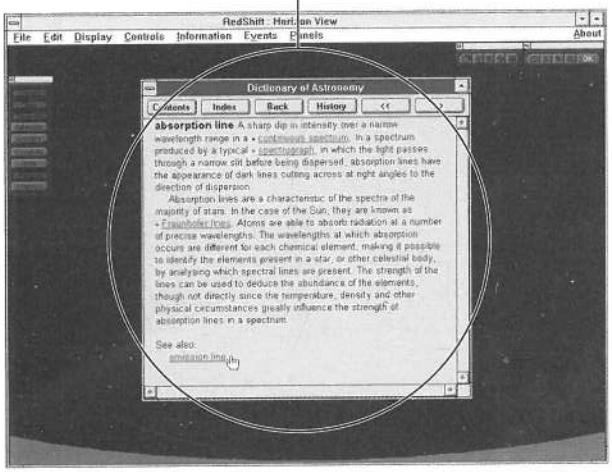
Return to normal sky viewing mode by selecting Return from the Information menu, or click *Return* in the icon bar.



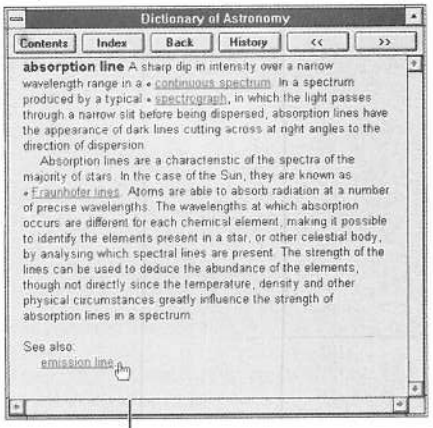
To find a named location (towns & cities or observatories on Earth, craters or landing sites on Moon, Mars and Venus), click *Find...* in the bottom panel section. See Find Location dialog (page 20) for further explanation.

DICTIONARY OF ASTRONOMY

RedShift 2 contains the fully revised and updated Penguin Dictionary of Astronomy by Dr. Jacqueline Mitton, with additional illustrations and animations.


File Edit Display Controls Information Events Panels About
Dictionary of Astronomy
Contents Index Back History << >>
absorption line A sharp dip in intensity over a narrow wavelength range in a • continuous spectrum. In a spectrum produced by a typical • spectrograph, in which the light passes through a narrow slit before being dispersed, absorption lines have the appearance of dark lines cutting across at right angles to the direction of dispersion.
Absorption lines are a characteristic of the spectra of the majority of stars. In the case of the Sun, they are known as • Fraunhofer lines. Atoms are able to absorb radiation at a number of precise wavelengths. The wavelengths at which absorption occurs are different for each chemical element, making it possible to identify the elements present in a star, or other celestial body, by analysing which spectral lines are present. The strength of the lines can be used to deduce the abundance of the elements, though not directly since the temperature, density and other physical circumstances greatly influence the strength of absorption lines in a spectrum.
See also:
emission line

To Enter the Dictionary of Astronomy, select Dictionary of Astronomy... from the Information menu. You can also reach the Dictionary articles by clicking any words which are highlighted in blue in the Photo Gallery or the Object Identification window.

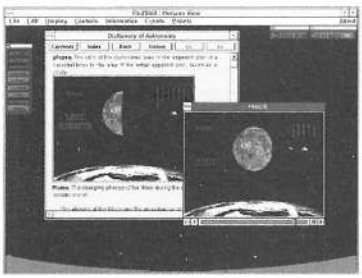

Dictionary of Astronomy
Contents Index Back History << >>
absorption line A sharp dip in intensity over a narrow wavelength range in a • continuous spectrum. In a spectrum produced by a typical • spectrograph, in which the light passes through a narrow slit before being dispersed, absorption lines have the appearance of dark lines cutting across at right angles to the direction of dispersion.
Absorption lines are a characteristic of the spectra of the majority of stars. In the case of the Sun, they are known as • Fraunhofer lines. Atoms are able to absorb radiation at a number of precise wavelengths. The wavelengths at which absorption occurs are different for each chemical element, making it possible to identify the elements present in a star, or other celestial body, by analysing which spectral lines are present. The strength of the lines can be used to deduce the abundance of the elements, though not directly since the temperature, density and other physical circumstances greatly influence the strength of absorption lines in a spectrum.
See also:
emission line

Underlined words or phrases denote cross-references. When the cursor passes over a cross-reference, it changes to a Click to link to the cross-reference.

If a subject described in the dictionary is featured in a movie, photo or as a section of a guided tour, clicking on the link will take you to the media.

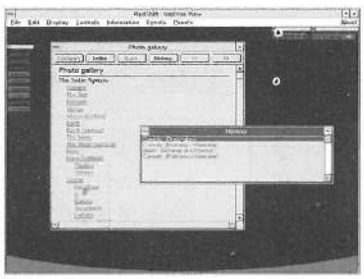
Click *Contents* to browse through the Dictionary headings.

Click *Index* to search for a heading in the Dictionary. Enter the first few letters in the Search field to jump to the nearest word in the index.



Several illustrations have associated animations. To play an animation click the icon. The animation will play in a separate window. To stop the animation, close the animation window.

Click *Back* to return to the previous article you accessed. « and » take you to the next and previous articles in the Dictionary.



Click *History* to display a list of the articles you have accessed. Double click on a heading to return directly to the associated article.

GUIDED TOURS

Guided tours are animations that explain major astronomical themes or take you through the sequence of an astronomical event, accompanied by a commentary. They form a visual introduction to some of the basic concepts of astronomy. This is why, when you open RedShift 2, you can either progress to the Main Program or begin with the Guided Tours. To access Guided Tours from within the Main Program, select Information, Guided Tours... This takes you to the Guided Tours Gallery. Choose any tour by clicking on its button.

The tours are organised in sections. To leap to a specific section of the tour, click in the progress bar that is displayed at the bottom of the tour window when it starts running. The tour will leap to the beginning of the section nearest to the mouse click. Similarly, you can click to go back if you want to watch a section again. To leave the tour, click *Back*.

Users upgrading from RedShift 1 should note that it had a feature called Guided Tours, but this has changed name in RedShift 2 and is now described overleaf.

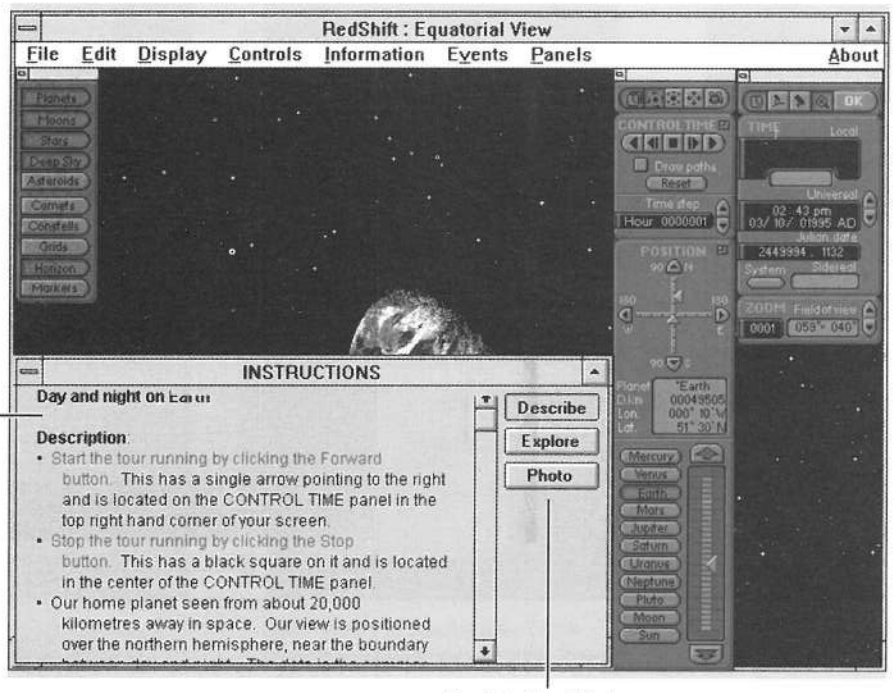
TUTORIALS

Tutorials take you to a location and conjunction that show an exciting astronomical event, and offer you advice on how to use control panels and filters to activate the simulation. For this reason, they are an excellent way of learning to use RedShift 2's sophisticated features.

To access Tutorials select Information, Tutorials...

The Instructions panel shows you a description of your position in space and time, and tells you how to use the tour (Describe); the Explore option gives suggestions for adjustments on the control panels that will change your view and the information available to you.

After using a Tutorial, choose Controls, Default Settings to return to the standard view of the sky from Earth.

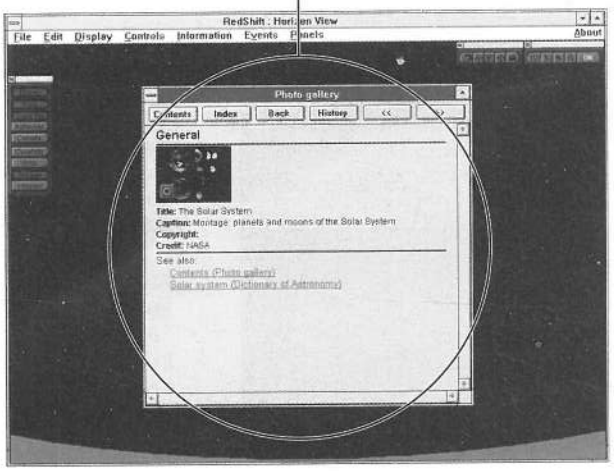

RedShift : Equatorial View
File Edit Display Controls Information Events Panels About
INSTRUCTIONS
Day and night on Earth
Describe
Explore
Photo
Description:
• Start the tour running by clicking the Forward button. This has a single arrow pointing to the right and is located on the CONTROL TIME panel in the top right hand corner of your screen.
• Stop the tour running by clicking the Stop button. This has a black square on it and is located in the center of the CONTROL TIME panel.
• Our home planet seen from about 20,000 kilometres away in space. Our view is positioned over the northern hemisphere, near the boundary

The tutorial will link you to relevant images in the Photo gallery.

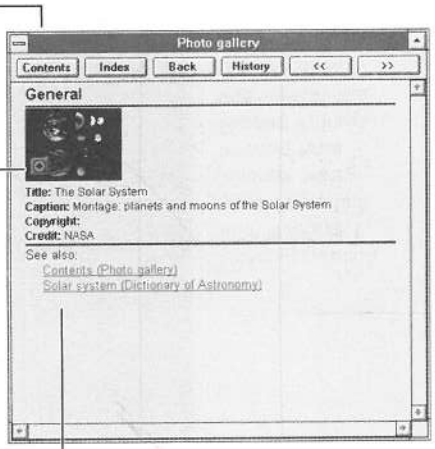
Users upgrading from RedShift 1 should note that Tutorials were referred to as Guided Tours in that version, but Guided Tours is now a different feature in RedShift 2; it is described on page 43.

PHOTO GALLERY & MOVIE GALLERY

RedShift 2 contains over 700 full screen photographs of planets, moons, nebulae, galaxies and other astronomy related subjects. RedShift also contains several short video sequences. Photographs are grouped by subject starting from the Sun and moving outwards to the most distant objects.



Click here to view the full screen image.



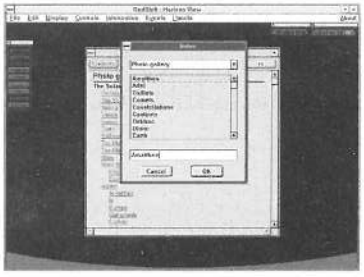
To Enter the Photo Gallery, select Photo Gallery... from the Information menu.

To Enter the Movie Gallery, select Movie Gallery... from the Information menu.

Click to link to a related article in the Dictionary of Astronomy.

Scroll down to see additional photographs

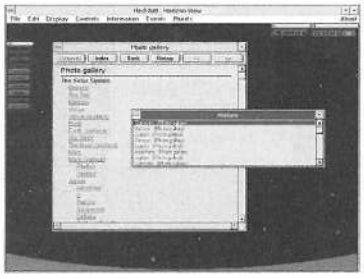
Click *Contents* to browse through the headings which the photographs and movies are grouped under. Click any heading to view a list of available photographs or movies.



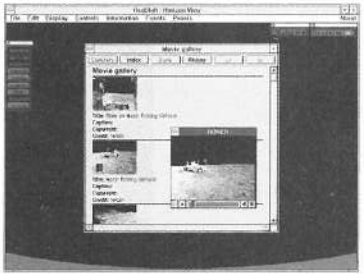
Click *Index* to search for a heading in the Photo or Movie Gallery. Enter the first few letters in the Search field to jump to the nearest point in the index.

Use the *Previous* and *Next* buttons to browse through the photographs, or *Return* to go back to the Photo Gallery.

Click *Back* to return to the previous heading you accessed. « and » take you to the next and previous headings in the Photo Gallery.



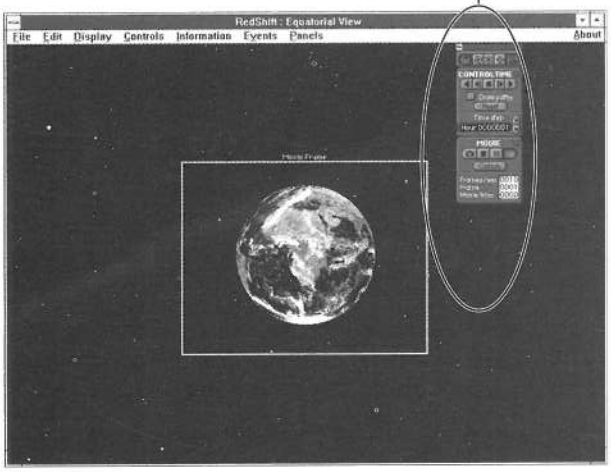
Click *History* to display a list of the photograph headings you have looked at. Double click on a heading to return directly to the list of photographs.



In Movie Gallery, click to play a movie. To stop viewing the movie, close the movie window.

MOVIE RECORDER

Movie Recorder lets you record Quicktime movies of the views created in RedShift 2. These can be used in other applications that support Quicktime.



To use the Movie Recorder, select Movie Recorder from the Controls menu, or click the button in the Controls icon bar.

Movie Recorder may be used in conjunction with any of the other panels, though normally Control Time will be used.

Warning - movies take up a lot of space on your disk drive. Keep them short to conserve space.

Use the Control Time panel while recording to capture planets and stars in motion.

Click here to add images one frame at a time.

The number of frames your movie will show each second.

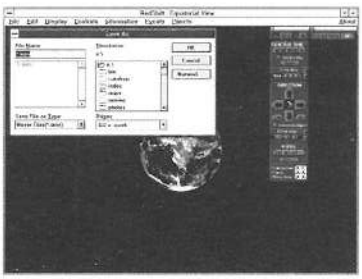
The number of frames your computer will be able to play back is dependent on the speed of your computer.

The number of seconds your movie will run for.

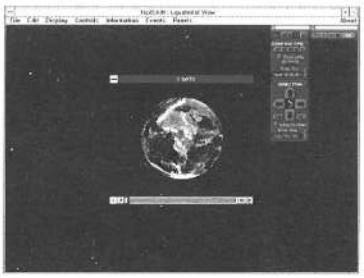
Use pause while setting up a new view.

Click here to start recording. A new frame will be recorded each time the view changes.

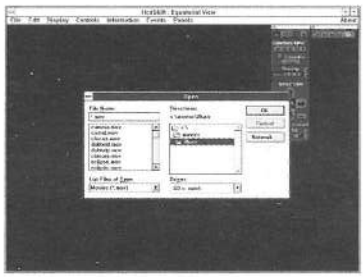
The total number of frames recorded so far.



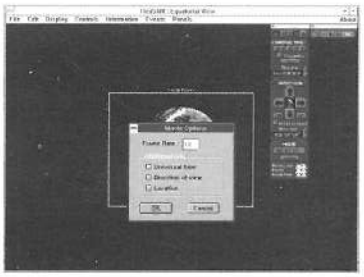
To run Movie Recorder you must first enter a file name for the new movie. Once you have chosen a file name click on *OK*.
A movie frame will appear in the center of the screen. This can be moved by dragging the title bar, or resized by dragging the bottom right corner.
To begin recording, press ⊙
Use Control Time and other panels to create additional frames.



When you press the ⊙ button in the Movie Recorder panel, your movie will appear in a new window. Click the play button to view it.



To replay a previously saved movie, select Open Movie... from the File menu. An Open File dialog will appear.



Click *Options* in the Movie Recorder panel to choose what information is displayed over the movie you record.

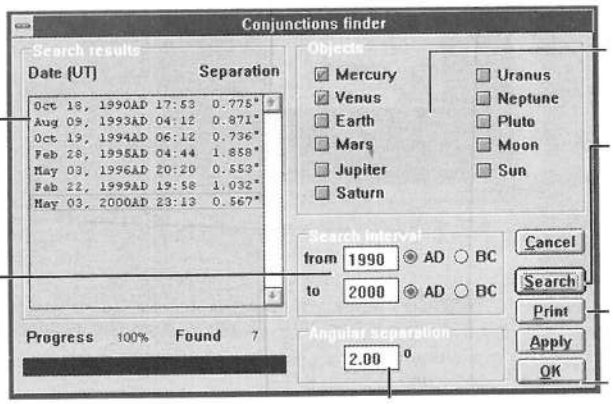
EVENTS - Conjunction Finder

The Conjunction finder predicts the conjunction of two or more planets for any period between 4712 BC and 11000 AD. The Conjunction finder also works with the Moon and Sun.
The Conjunction finder can predict conjunctions viewable from any of the planets (including Earth) or from a heliocentric location, as set in the Location panel.

To access the Conjunction Finder choose Events, Conjunctions....

RedShift 2 displays the date and time of every conjunction which occurs within your selected period. After selecting a conjunction, click *Apply* to simulate the event.

Enter the start and end dates for your search. Select *AD* or *BC*.



Click two or more object names to find their conjunction

Click to execute the search. *Search* button changes to *Stop* during a search. Click *Stop* to terminate the search; the results of the search remain available.

Click to print a report on the results of your search.

Click to simulate a conjunction selected from the Search results list. If you apply a simulation, RedShift will change your current time and direction settings.

Enter the maximum value for the angular separation of the objects (up to a maximum of 5 degrees).

The number of conjunctions found will depend on the number of objects selected and their distance from each other. For the inner planets a maximum period of 100 years is recommended. Searching for conjunctions between the outer planets will take longer.

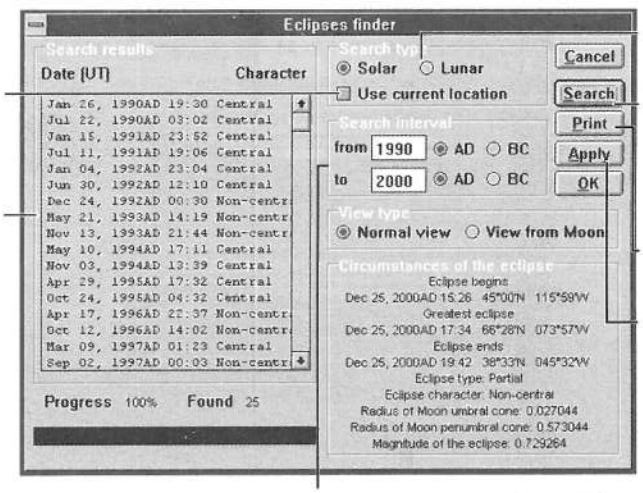
EVENTS - Eclipse Finder

Eclipse finder predicts the occurrence of Solar and Lunar eclipses for any period between 4712 BC and 11000 AD.
Eclipse finder can only predict eclipses which are viewable from Earth.

To access Eclipse Finder choose Eclipses from the Events menu.

Click if you wish to limit your search to those eclipses which are visible only from the current location setting.

RedShift 2 displays the date and time of every eclipse which occurs within your selected period. Select an eclipse to get further information about the circumstances of the eclipse. Once you have selected an eclipse, click *Apply* to simulate the event



Click *Solar* or *Lunar* to search for Solar or Lunar eclipses

Click to execute the search. *Search* changes to *Stop* during a search. Click *Stop* to terminate the search; the results of the search remain available.

Click to print a report on the results of your search.

Click to simulate any eclipse selected from the Search results list. If you apply a simulation RedShift will change your current time, direction, location (unless you have checked *Use current location*) and zoom settings. Phases are automatically switched to No phase for Solar eclipses viewed from the earth (**Display, Object Filters... Planet**).

Enter the start and end dates for your search. Select *AD* or *BC*. Because of the complexity of the calculations performed, it is recommended that searches are restricted to a period of 10 years or less.

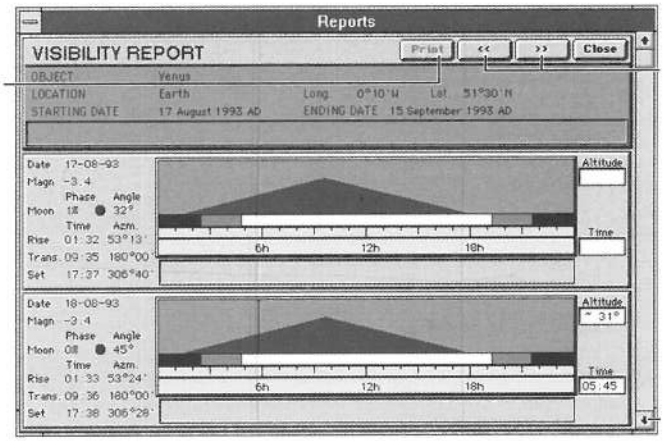
Eclipse finder performs orbital mechanics calculations to predict when an eclipse will occur. It therefore achieves a higher level of accuracy between 1411 BC and 3002 AD, than for the full time period over which RedShift operates.

VISIBILITY REPORTS - Object Visibility Reports

Object Visibility Reports give information on any object's visibility for a period of up to 30 days. There are four Object Visibility Reports, containing information on altitude, the Moon's location, and two summary tables, one of which can be printed. Object Visibility Reports are only available when your location is on Earth.

Access Object Visibility Reports by clicking Reports in any object's information window.

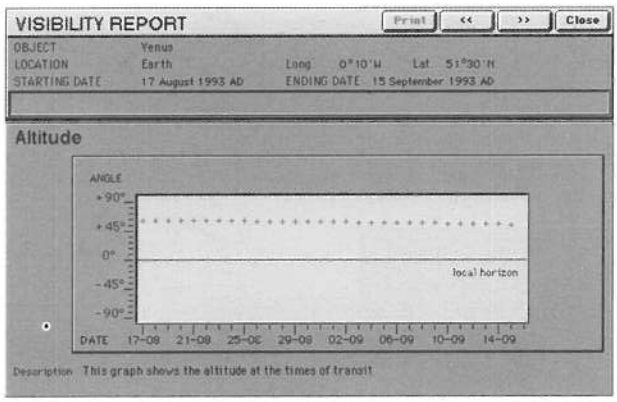
Click here to print a visibility report (only available on summary panel).



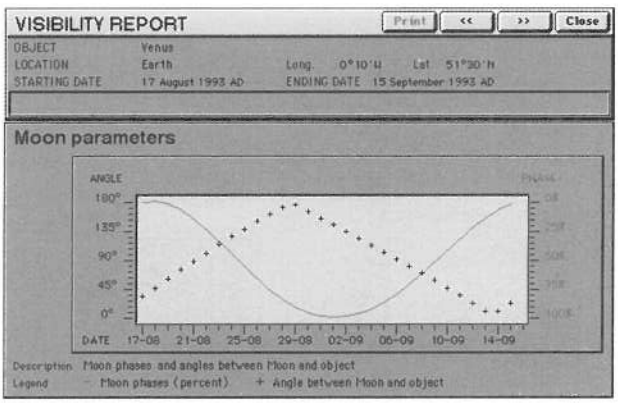
Click these buttons to step to the next or previous report.

Click here to see visibility reports for subsequent days.

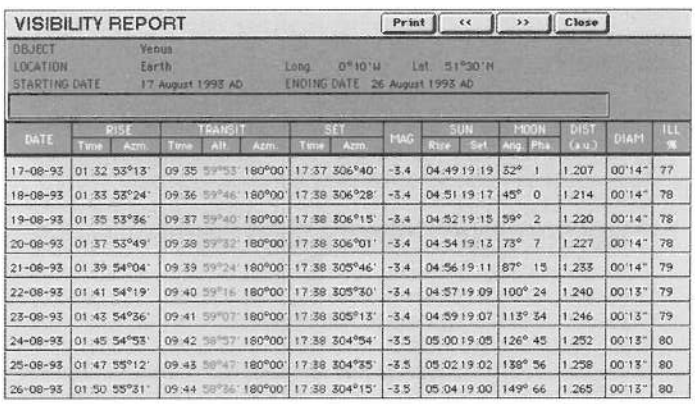
This report shows the object's rise, set, location and altitude throughout the day.



The Altitude report shows the selected object's altitude at time of transit for the period of the report.



The Moon parameters report shows the phase of the moon and the angle between moon and object for the period of the report.



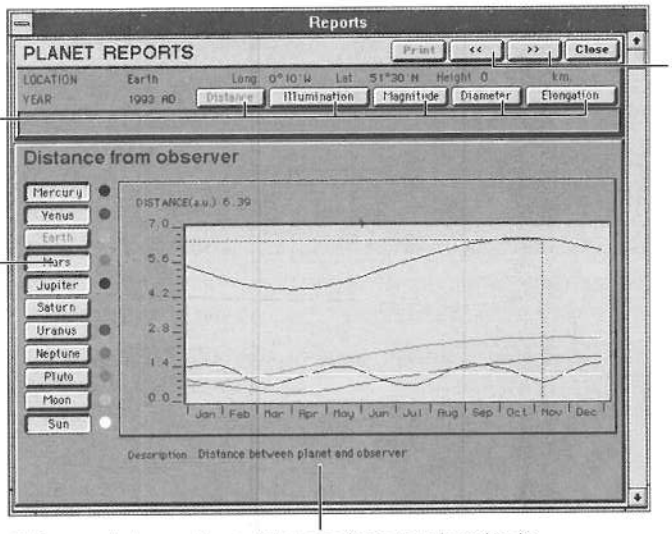
DATE	RISE		TRANSIT			SET		MAG	SUN		MOON		DIST	DIAM	ILL
	Time	Azm.	Time	Alt.	Azm.	Time	Azm.		Rise	Set	Ang.	Phs	(a.u.)		%
17-08-93	01:32	53°13'	09:35	59°53'	180°00'	17:37	306°40'	-3.4	04:49	19:19	52°	1	1.207	00'14"	77
18-08-93	01:33	53°24'	09:36	59°46'	180°00'	17:38	306°28'	-3.4	04:51	19:17	45°	0	1.214	00'14"	78
19-08-93	01:35	53°36'	09:37	59°40'	180°00'	17:38	306°15'	-3.4	04:52	19:15	59°	2	1.220	00'14"	78
20-08-93	01:37	53°49'	09:38	59°32'	180°00'	17:38	306°01'	-3.4	04:54	19:13	73°	7	1.227	00'14"	78
21-08-93	01:39	54°04'	09:39	59°24'	180°00'	17:38	305°46'	-3.4	04:56	19:11	87°	15	1.233	00'14"	79
22-08-93	01:41	54°19'	09:40	59°16'	180°00'	17:38	305°30'	-3.4	04:57	19:09	100°	24	1.240	00'13"	79
23-08-93	01:43	54°36'	09:41	59°07'	180°00'	17:38	305°13'	-3.4	04:59	19:07	113°	34	1.246	00'13"	79
24-08-93	01:45	54°53'	09:42	58°57'	180°00'	17:38	304°54'	-3.5	05:00	19:05	126°	45	1.252	00'13"	80
25-08-93	01:47	55°12'	09:43	58°47'	180°00'	17:38	304°35'	-3.5	05:02	19:02	138°	56	1.258	00'13"	80
26-08-93	01:50	55°31'	09:44	58°36'	180°00'	17:38	304°15'	-3.5	05:04	19:00	149°	66	1.265	00'13"	80

This report summarises in text form all visibility information for each day of the report. This report can be printed.

VISIBILITY REPORTS - Planetary Reports

Planetary Reports give information on planets' visibility over the course of a year. There are five reports in the Planetary Reports, containing information on distance, illumination, magnitude, diameter and elongation.

Access Planetary Reports by clicking *Reports* **in any planet's information window.**

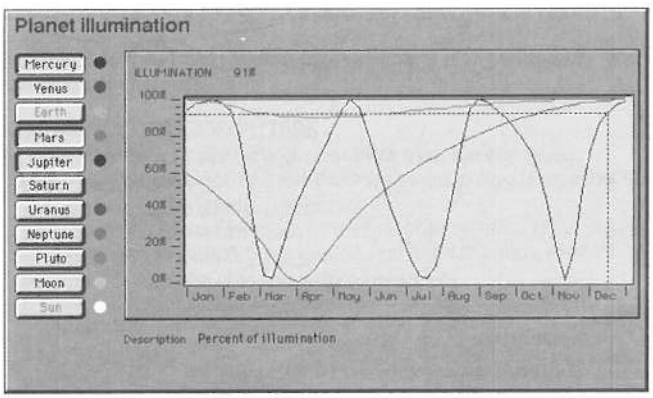


Click these buttons to step to the next or previous report.

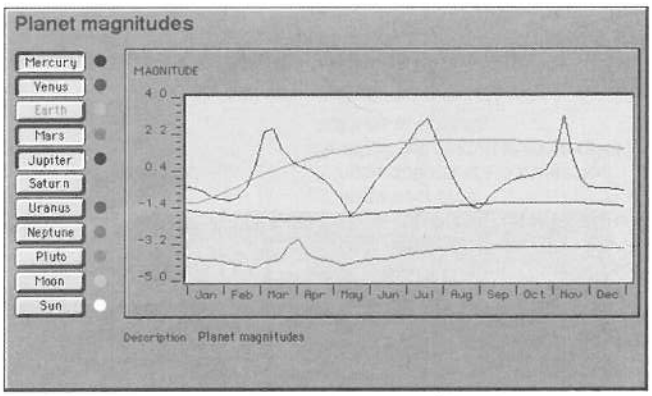
Click one of these buttons to see one of the other four kinds of visibility report.

Click on a planet button to add information about that planet to the display.

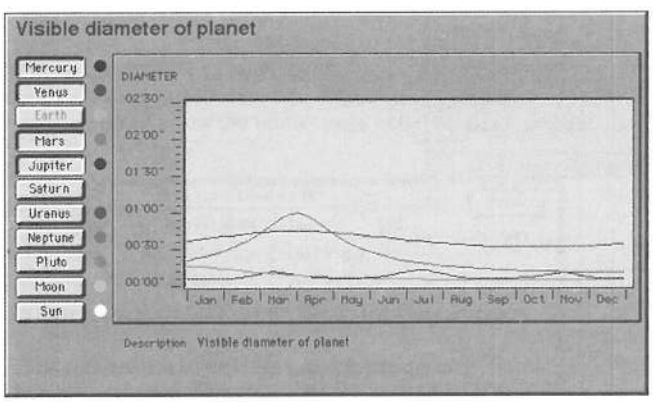
This report shows planet distances from your location in astronomical units (a.u.).



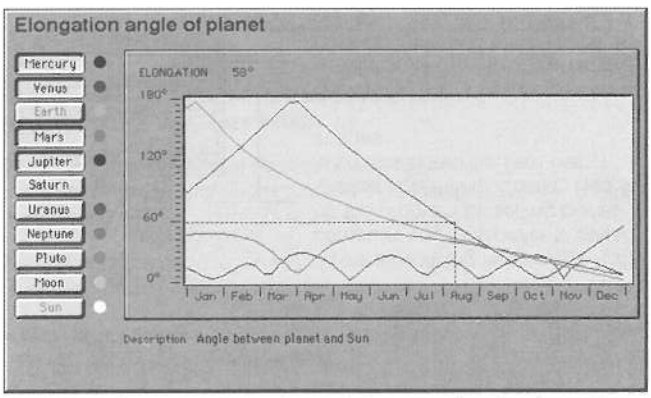
The illumination report shows the percentage of planet surfaces lit by the Sun as seen from your location.



The magnitude report shows the brightness of the planets as seen from your location.



The diameter report shows the apparent size of the planets in minutes and seconds as seen from your location.

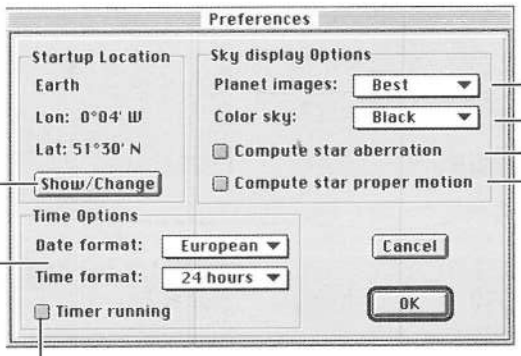


The elongation report shows the angle between the planets and the Sun as seen from your location.

PREFERENCES

Setting preferences allows you to control a number of options which apply globally to RedShift 2. Information is saved to your hard disk each time you click OK in the Preferences dialog.

Access the Preferences dialog using File, Preferences...



Click to select a new default location when RedShift starts up.

Click on *American* or *European* to switch between date formats used in RedShift.

Click *Timer running* and RedShift will start up with real time running (equivalent to selecting Start Time from the Controls menu). See Working with Time (page 17) for more information.

If you are running RedShift on a slow computer you may prefer to speed up the program by setting planet images to *Better* or *Coarse*. RedShift is pre-set to use the Best planet images.

Click *Natural color sky* to display a simulation of daylight, dawn and dusk on Earth and Mars. No other planets in the Solar system have a transparent atmosphere. If *Natural color sky* is not selected, RedShift always shows the sky as black even during daylight hours.

Click *Compute star aberration* and *Compute* star proper motion to have RedShift make the most accurate calculations for stars. *Compute star proper motion* also allows you to observe the constellation patterns change over time.
If these options are not selected, RedShift will calculate more quickly but less accurately.

PRINTING - printing sky charts

RedShift 2 lets you print high quality sky charts along with other information about the current view. RedShift prints the current view shown on your screen.

FOR WINDOWS COMPUTERS

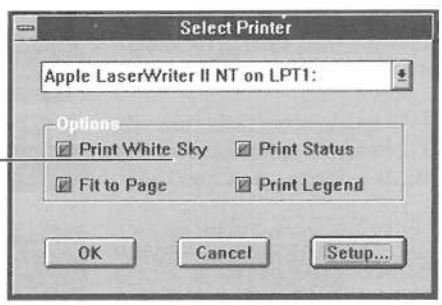
To print your current sky view choose Print from the File menu.
To configure printing options use the Print setup dialog (File, Print Setup...).

Click *Print White Sky* to print celestial objects black on a white sky background. To make the chart look more like the real night sky click Print White Sky off.

To print the sky chart on one page regardless of the size of the chart, click *Fit to Page* on.

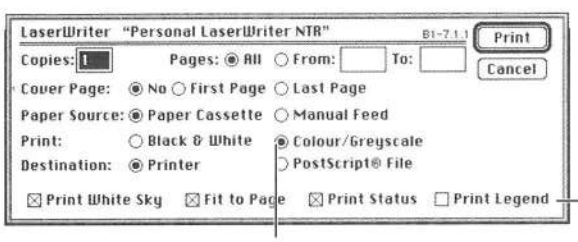
To print information about the current projection, time, location, direction of view and zoom, click *Print Status* on.

To print a table showing object symbols along with your sky chart, click *Print Legend* on.



FOR MACINTOSH COMPUTERS

Access the Print dialog using File, Print... The appearance of the Print dialog depends on which type of printer you are using. You may wish to adjust the printer page settings before printing. Use the Page setup dialog (File, Page Setup...).



Make sure you select *Color/Greyscale* if you are going to print a large picture of a planet or moon.

Select *Print White Sky* to print celestial objects black on a white sky background. To make the chart look more like the real night sky click *Print White Sky* off.

To print the sky chart on one page regardless of the size of the chart, click *Fit to Page* on.

To print information about the current projection, time, location, direction of view and zoom, click *Print Status* on.

To print a table showing object symbols along with your sky chart, click *Print Legend* on.

SAVING & RESTORING VIEWS - Windows

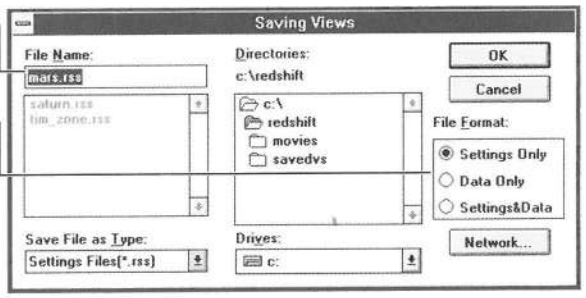
RedShift 2 lets you save and restore your work and the views you have created. For example, you can save a view of a solar eclipse then load it from disc. You can also save the settings that you want to use each time you start the program.

Access the Save As dialog using File, Save As...

To save your current view enter the name of the file you wish to use in the file name field.

Use the File Format buttons to give RedShift instructions on what type of data you are going to store. RedShift can save three types of file. When a file has been saved the file extender indicates the type of file it is.

Note that you cannot save your view when time is running.



Choose Settings Only (*.RSS) to save display options (such as projection, planet display options and which panels are open).

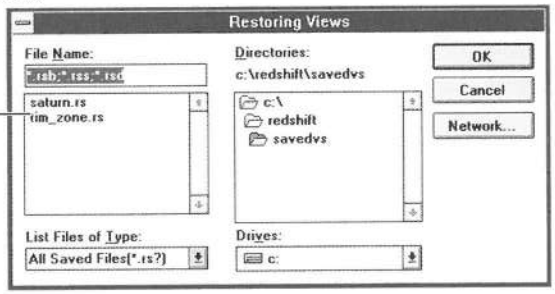
Choose Data Only (*.RSD) to save the current time, location, direction of view,Zoom factor, and time steps.

Choose Save Settings & Data (*.RSB) to save all the information needed to restore your current view.

To Restore saved views use the Open file dialog.

Access the Open File dialog using File, Open...

The dialog shows only files created by RedShift. To open a file, double-click its name or select it and click OK.



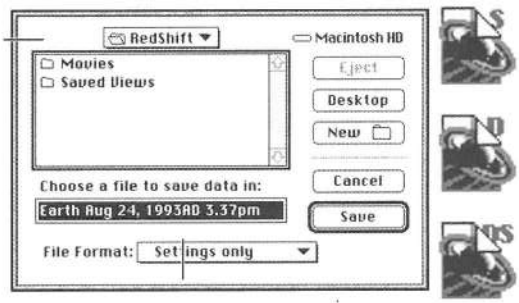
SAVING & RESTORING VIEWS - Macintosh

RedShift 2 lets you save and restore your work and the views you have created. For example, you can save a view of a solar eclipse then load it from disc. You can also save the settings that you want to use each time you start the program.

Access the Save As dialog using File menu, Save As...

To save your current view choose an existing folder or click *New folder*. Enter the name of the file you wish to use in the file name field if you do not wish to use the one created by RedShift.

To create a file that RedShift will automatically load each time it starts, name the file Startup. The Startup file must be in the same folder as the RedShift application.



Choose Settings Only to save display options (e.g. projection, planet display options and which panels are open).

Choose Data Only to save the current time, location, direction of view,Zoom factor, and time steps.

Choose Save Settings & Data to save all the information needed to restore your current view.

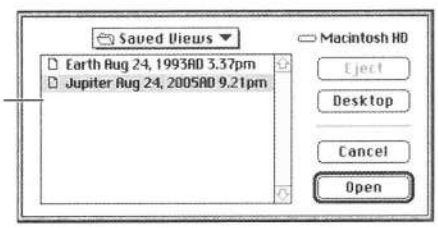
Use the File Format pop-up menu to choose what type of data you are going to store. When a file has been saved the file icon indicates the type of file it is.

Note that you cannot save your view when time is running.

To Restore saved views use the Open file dialog.

Access the Open File dialog using File menu, Open...

The dialog shows only files created by RedShift. To open a file, double-click its name or select it and click *Open*.



REDSHIFT SETTINGS

The simplest way to find out about RedShift 2 is to use it. Follow the Visual Guide to learn how to use the control panels and dialog boxes. The following section explains how choosing settings in the panels controls the operation of the software.

Four main variables are used together or individually to control RedShift.

Time
Location (the location on a planet or in space from which you are looking)
Direction (the direction in which you are looking)
Zoom (magnification factor)

In addition there are two special modes for viewing planets and their moons.

TIME

Each time you run RedShift it picks up the current time and date set on your computer (system time). The correct position of the stars and planets are calculated using this time and date so it is important that your system time is correctly set. See below for an explanation of the effects of daylight saving.

You can use RedShift to simulate astronomical events that took place in the past, or are forecast to take place at some time in the future. You can enter a new time and date using the Time settings panel. Local time on Earth depends on the longitude of your current location (see Location below), so astronomers normally specify the time of an event using universal Time. Universal time is the current time at the prime meridian (0 degrees longitude) without daylight saving applied. If you have set a heliocentric location or a location on another planet or moon you may only specify time as universal time.

Daylight saving
RedShift calculates universal time (time at 0 degrees longitude excluding any daylight saving) by checking the system time currently set on your computer and your longitude as set in the Location panel. The Time zone field on the Location panel displays the number of hours that universal time is ahead or behind local time. RedShift calculates universal time and the time offset only when the Time zone field is switched to automatic (i.e. it is backlit).

Because of local variations in daylight saving (and adjustments which are sometimes made to standardise time within civil boundaries) it may be necessary for you to make an adjustment to the offset between local and universal time by changing the value in the Time zone field. If the Time zone field is currently set to automatic (i.e. it is backlit) you will need to click Manual before you can enter a new value. Enter the correct number of hours difference between your Local time and Universal time. For example, if you have set your system clock to allow for 1 hour of daylight saving in your region, you will need to add 1 hour to the value currently shown in the Time zone field. When you change the number of hours in the Time zone field your local time will be updated; click system on the Time panel to set your local time back to your system clock time and universal time will be updated to show its correct value.

When you change location to a new longitude, release the manual over-ride to allow RedShift to calculate the time zone. If you need to modify the calculated figure to allow for daylight saving or national time zone, click the manual button and apply your correction to the Time zone field.

Because most astronomical events are specified in universal time, it is important to have the universal time correctly set.

Tracking time
Astronomical events can take hours, days or even years to occur. To simulate astronomical events, you can speed up time using the Control Time panel. The time steps field lets you select units of minutes, hours, days or years and enter the number of the units that you want to pass each time RedShift 2 updates the screen (for example you might choose one-day steps to watch the Moon orbit the Earth). The actual speed at which RedShift can move the objects on the screen depends on the speed of your processor. Remember that RedShift accurately calculates the position of a planet or moon for each new time step; it also calculates where the Sun currently is in relation to the planet in order to show the correct phase (shadow) on the surface of the planet.

If you have the Time settings panel open while tracking time you can see that the current time is being updated with each time step. After you have stopped time running you can reset time by clicking Reset on the Control Time panel.

Running 'real' time
RedShift can also operate with real time running. Start Time (Controls menu) updates the sky display approximately every minute. With real time running RedShift will simulate the changes in the sky as they occur. Stop real time running if you are going to use time tracking.

LOCATION

'On Macintosh computers, the initial location is taken from the computer's Map control panel. On Windows computers RedShift sets your location to London, England. RedShift provides several ways to choose a new location. These are described below.

Changing latitude and longitude
The Location settings panel lets you set a new location by entering latitude and longitude. To remind you, lines of latitude run parallel to the equator and are measured in degrees North and South of the equator; lines of longitude run between the poles and are measured in degrees east and west of the prime meridian (0 degrees longitude). Don't forget to check that East or West (E or W) is correctly set when you enter a new longitude, and that North or South (N or W) is correctly set when you enter a new latitude.

The Location settings panel also allows you to be located on another planet or moon, or anywhere in space within the Solar System (Heliocentric location). Click on Earth at the top of the Location panel. As you click on this field you cycle through the names of the nine planets, the Moon, the Sun and Heliocentric. When you see a planet name with an arrow to the left of it it means that the planet has moons which you can locate your viewing position on. Click the arrow to cycle through a list of the available moons (or satellites) belonging to that planet. Choosing a location on a moon to view a planet or another moon can give some exciting views. Take a look at the guided tour which uses a location on one of Saturn's moons to observe another moon as it orbits Saturn.

Choosing a named location
A new viewing location can be selected by choosing one of the named sites from RedShift's extensive gazetteer. The Find Location dialog (Controls menu) lets you choose from a list of towns and cities or a list of well known observatories (click Sites to open the Gazetteer window). Gazetteers are also provided for the Moon, Mars and Venus (instead of towns, cities and observatories, the gazetteers list geographic features and landing sites of space missions).

If you are interested in seeing the surface maps of the Moon, Mars Venus or the Earth in greater detail, choose Maps from the Information menu. Map mode lets you navigate around full screen versions of the surface maps of the Moon, Mars, Venus and the Earth (the maps are

held as large globes in the same way as the 3D planet models). In map mode you can also access the gazetteers, center the map on a selected location and use it as your new viewing location.

If you open the Time settings panel and the Location panel at the same time, you can see that choosing a new location changes the local time. RedShift 2 keeps track of your current viewing location and adjusts the local time accordingly.

DIRECTION

RedShift provides several ways to control which part of the sky you are looking at (the direction of view). If you know the name of an object you want to observe (such as a star or a comet), use the Find object dialog (Controls menu). The selected object will be highlighted with two small arrows and the Object window will appear. This window provides technical information about the object. The Object window also allows you to center your view on the selected object (you can center on chosen objects automatically by setting this as an option in the Preferences dialog or in the Find Object dialog).

Finding planets and moons
If you want to look at a planet or the Moon use Center on Planet (Controls menu). If you choose a planet or a moon that is a long distance from your current viewing location, it will appear as a dot on the screen. To see a distant planet in detail use the Zoom panel. Or you may want to change your location to somewhere nearer to the planet. Alternatively can use one of the special planet viewing modes described below.

Locking on a planet or moon
Once you have used Center on Planet (or centered on a moon using the Find object dialog) you have the option to lock your viewing direction to the selected object. If you center on a planet or moon and then run time, the object will continue in its orbit and disappear off the edge of your screen. Locking the object lets you track the path of the planet or moon. You cannot change your direction of view while you are locked on an object. You can unlock using the Controls menu or by clicking Locked on object on the Direction panel (the Locked on object button is checked while you are locked).

Direction panel
The Direction panel is a simple tool which you can use for navigating around the sky. Click the arrow buttons to move your view up and down, left and right. The amount which your direction of view changes with each click can be controlled by changing the value in the Move step window.

Entering celestial co-ordinates
The most flexible way to control your direction of view is to use the Center on panel. This panel lets you enter a viewing direction using one of two co-ordinates systems. If you don't understand how the Right Ascension/Declination (RA/Dec) or the Azimuth/Altitude co-ordinates systems work, take a look at the explanations in the online version of the Penguin Dictionary of Astronomy.

Constellations, grids and markers
As you move your direction of view around the sky, it is very easy to lose track of which direction you are looking. The constellations were drawn by early astronomers to help them map the sky. Initially the constellations were defined only to cover the path which the Sun follows through the year (these are called the Zodiacal Constellations). Greeks distinguished 48 constellations in 150 AD (Ptolemy). Other astronomers added many more (Bayer, Hevelius and others). In 1930 the list was reduced to 88 and standardised. Click Constellations in the filters panel to switch on the boundaries, outlines and names of the constellations. This will help you keep track of your current direction of view. You can also click Grids to lay a labelled grid over the area of the sky you are observing or Markers to mark the main points in the sky .

ZOOM

Zoom controls the angle of view that is displayed. Increasing the zoom factor decreases the area of sky that is displayed. RedShift 2 lets you enter a zoom factor anywhere between 0.2 and 9999. Zoom factor 1 gives an angle of view similar to that seen by the naked eye. At 0.2 zoom RedShift shows the sky as a celestial sphere. Setting a very large zoom factor may result in nearby planets and moons obscuring your view.

You can also zoom in using the eye icons on the Direction panel, or by dragging a marquee over an area of the screen (drag a marquee with the CTRL key (OPTION for Macintosh) key pressed to zoom out). If you drag a marquee several times over the same area, the zoom factor will become so large that it may no longer possible for the software to accurately position an object in the center of the screen.

PLANET VIEWING MODES

To get the best views of a planet an observer needs to be located in space close to the planet. This requires the ability to set the correct heliocentric co-ordinates and direction of view. To make it simple to view planets, RedShift includes two special planet viewing controls.

Move around planet
Move around planet (Position panel) initially locates you in space above the Earth (unless you have selected a location on another planet, in which case Move around planet starts with a view of this planet). Location is automatically set directly above the latitude and longitude currently set in the Location panel. A new planet can be selected simply by clicking one of the planet buttons. The sliders allow the planet to be viewed from any direction. By dragging the North/South and East/West sliders you move your viewing location around the planet (the current co-ordinates and height above the planet are displayed in the readout on the panel). The initial distance from a planet is automatically calculated to show the planet at a pre-set size. Distance from the planet is controlled using the distance slider (note that where a planet has moons, a blue bar appears on the distance slider indicating the average distance of the outermost moon from the surface of the planet).

Using Move around planet in conjunction with the Control Time panel allows you to observe the motion of planet/moon systems.

You must close the Position panel before you can change your direction of view.

Follow planet
Follow planet positions you on an orbital path around the sun, parallel to the orbit of a planet. Initially your direction of view is centered and locked on the planet. You can view the planet from any of six pre-set directions. You can release this directional lock, while remaining in Follow planet mode.

A new planet can be selected simply by clicking one of the planet buttons. Used in conjunction with the Control Time panel, Follow planet allows you to track a planet (or planet/moon system) as it orbits the Sun. RedShift calculates the orbit of the planet accurately and shows the correct phase of the planet for any point in time. It may help understand the orbital path of the planet if you display constellations or grids.

The initial distance from a planet is automatically calculated to show the planet at a pre-set size. Distance from the planet is controlled using the distance slider (note that where a planet has moons, a blue bar appears on the distance slider indicating the average distance of the outermost moon from the surface of the planet).

Since Follow planet locks your view on the planet, you will have to unlock before you can change your direction of view.

APPENDIX

PLANETS, MOONS AND STARS

PLANETS

RedShift 2 contains models of the nine planetary systems. The surfaces of Mercury, Venus, the Earth and Mars (and several moons – see below) have been imaged using shaded relief maps. The shaded relief maps have been scanned, enhanced and then mathematically wrapped around a sphere to create a three dimensional object. The other five planet images have been created by artists using a variety of photographic reference material.

MOONS

The model of Earth's Moon has also been created using shaded relief maps. The following moons have been treated in the same way (although some surface areas have been left blank where no mapping data is available):

Jupiter's moons: Io, Ganymede, Callisto, Europa
Saturn's moons: Mimas, Dione, Rhea, Tethys, Enceladus, Iapetus

Mars' moons, Phobos and Deimos, are irregular. These are represented as scalable two-dimensional images. All other moons in the solar system are shown as grey spheres.

MAPS

RedShift contains detailed surface maps (with associated gazetteers) for the Earth, Moon, Mars and Venus. These surface maps are held as three-dimensional spheres which can be rotated. Because a large amount of memory is needed to manipulate the surface maps, Map mode operates independently of the main view of the sky.

ASTEROIDS AND COMETS

RedShift contains orbital data on 5,011 asteroids. Asteroids (which are also known as Minor Planets) orbit the Sun in a belt which is located between Mars and Jupiter. The asteroid belt can be viewed by choosing a Heliocentric location with latitude set to 90°, and a height of 10 astronomical units (a.u.) or more. Center your view on the Sun and set the required range of Asteroid sizes using the Asteroids Filter dialog.

RedShift also lets you view around 100 short period comets.

STARS

At the heart of RedShift is a catalogue of approximately 250,000 stars. Each star is accurately positioned with its spectral type indicated by its color. Stars can be filtered using their magnitude, spectral type and luminosity class. RedShift can display some stars to magnitude 12 (smaller stars have higher magnitude values).

Default settings display all stars to magnitude 6. Use the Stars Filter dialog (Display, Stars...) to control the magnitude and therefore the number of stars displayed. Use a zoom factor of 2 or above to see the maximum number of stars that RedShift can display.

DEEP SKY OBJECTS

These are objects beyond our galaxy. RedShift contains a catalogue of approximately 40,000 deep sky objects, including galaxies, nebulae and star clusters. Deep sky objects are represented as symbols. The Deep Sky Filter dialog (Display, Deep Sky...) allows you to select which objects are displayed and contains a key to the symbols.

ACCURACY OF POSITIONS

THE MOON AND PLANETS

The best published positions for the Moon and Planets are those given each year in the Astronomical almanac. These positions are calculated numerically using the "DE200" computer program of the USA's Jet Propulsion Laboratory. DE200 is fine for positions between 1850 and 2050 AD, but a slightly different program "DE102" is needed for calculating positions over the much larger time interval of 1411 BC to 3002 AD.

In RedShift 2 the positions of the Moon and Planets are based on the DE102 calculations. The differences between RedShift and DE102 positions are extremely small and no larger than the differences between DE200 and DE102. This implies that over the period 1850 to 2050AD the RedShift positions are typically good to about two arc-seconds for the planets, and about five arc-seconds for the Moon. Over the extended period of 4712 BC to 10,000 AD the RedShift positions are thought to be better than ten arc-seconds for the outer planets, thirty arc-seconds for the inner planets, and a few arc-minutes for the Moon.

SATELLITES

The majority of the planets in the Solar System have satellites orbiting around them. RedShift computes positions for both of Mars' satellites, 14 of Jupiter's satellites, 9 of Saturn's, 2 of Uranus's, and Pluto's satellite Charon. RedShift uses the best available data for all the satellites and their positions agree with those in the Astronomical Almanac to typically about 2 arc-seconds. However, current orbital data are not sufficiently reliable for the positions to be trusted over greatly extended periods of time.

ASTEROIDS AND COMETS

The orbits of every asteroid and comet about the Sun are defined by a set of six astronomical constants. RedShift computes the orbits of the asteroids and comets using the best available values for these constants. However these orbits ignore the gravitational effects of the planets. Consequently, the accuracy of positions will gradually get worse as you move forwards and back in time.

The new Space Flight feature calculates the position and orbits of selected asteroids and comets to a higher level of accuracy.

Accuracy, **64**
Altitude, **25**
Asteroids
  diameter, **17**
  display, **17**; see also Panel, filter
  eccentricity, **17**
  filter dialog, **17**
  find, **27**
  groups, **17**
  labels, **17**
  view, **63**; see also Panel, filter
Atlas views, see Projections
Azimuth, **25**
Celestial equator, see Markers
Celestial sphere, **62**
Clusters, see Deep Sky Objects
Comets
  display, **17**; see also Panel, filter
  filter dialog, **17**
  find, **27**
  labels, **17**
Conjunctions
  find, **49**
  print report, **49**
  search for, **49**
  simulate, **49**
Constellations
  boundaries, **13, 61**
  display, **13**; see also Panels, filter
  filter, **8**
  filter dialog, **13**
  find, **27**
  names, **13**
  options, **8**
  patterns, **13**
  zodiacal, **13, 61**
Control panel
  icons, **6**
Controls menu, **5**
Date format
  change, **55**
Daytime sky, see Natural sky color
Declination, **25**
Deep sky objects, **7, 11, 63**
  display, **11**; see also Panel, filter
  filter dialog, **11**
  find, **27**
  labels, **11**
  magnitude, **11**
  type, **11**
Dictionary
  browse, **42**
  contents list, **42**
  cross references, **41**
  find headings, **42**
  index, **42**
  open, **41**
  refer to, **41**
  search, **42**
  search history, **42**
Direction
  altitude, see Altitude
  azimuth, see Azimuth
  center of view, **25**
  center on, **25, 61**
  control, **25**
  declination, see Declination
  move step, **25**
  of view, **7, 25, 31, 33, 36, 61**
  panel, **25**
  right ascension, see Right Ascension
  set, **25**
Eclipse
  find, **50**
  print report, **50**
  search for, **50**
  simulate, **50**
Ecliptic, see Markers
Ecliptic grid, see Markers
Ecliptic axes, see Markers
Ephemerides reports, **29**
Epoch, **18**
Find
  asteroids, **27**
  comets, **27**
  constellations, **27**
  deep sky objects, **27**
  dictionary headings, **42**
  locations, **22**
  moons, **27**
  movies, **46**
  photos, **46**
  planets, **27**
  stars, **27**
Follow planet, see Planets
Galaxies, see Deep sky objects
Grids
  display, **14**; see also Panels, filter
  filter, **8**
  filter dialog, **14**
  labels, **14**
  options, **8**
  quality, **14**
Guided tours, **43**
Horizon
  display, **15**; see also Panels, filter
  filled, **15**
  filter dialog, **15**
  opaque, **15**
  transparent, **15**
Horizon line, see Markers
Icon bars
  controls group, **5**
  settings group, **5**
Label
  asteroids, **17**
  comets, **17**
  constellations, **13**
  deep sky objects, **11**
  grids, **14**
  map locations, **21, 39**
  moons, **37**
  planets, **37**
  stars, **10**
Location
  Earth, **19, 21, 39**
  find, **19, 20, 60**
  find location dialog, **21**
  find locations, **22**
  gazetteer, **22**
  height, **19**
  heliocentric, **19**
  latitude, **19, 60**
  locator globe, **22, 39**
  longitude, **19, 60**
  Mars, **19, 21, 39**
  Moon, **19, 21, 39**
  moons, **20**
  name field, **19, 20**
  named features, **22**
  named observatories, **21, 22**
  named sites, **21, 22**
  named towns & cities, **21, 22**
  observing, **21**
  planets, **19**
  set, **19**
  Venus, **19, 21, 39**
Lunar eclipse, see Eclipse
Magnify, see Zoom
Maps
  change scale, **39**
  display, **39**
  display grids, **39, 40**
  display labels, **39, 40**
  Earth surface, **39,**
  find named location, **39**
  gazetteers, **39, 40**
  Mars surface, **39**
  Moon surface, **39**
  Venus surface, **39**
  return to sky view, **39, 40**
  use location on, **39**
Markers
  celestial equator, **16**
  celestial poles, **16**
  display, **16**; see also Panels, filter
  horizon line, **16**
  nadir, **16**
  vernal equinox, **16**
  zenith, **16**
Minimum system requirements, **2**
Moons
  distance from planets, **37**
  find, **27**
  magnification sliders, **37**
  rotation about planets, **37**
Move around planet, see Planets
Move step, see Direction
Movie gallery
  browse, **46**
  contents list, **46**
  find movie, **46**
  index, **46**
  open, **45**
  play movie, **46**
  search, **46**
  search history, **46**
Movie recorder
  frames per second, **47**
  frames recorded, **47**
  movie frame, **48**
  pause, **47**
  play, **48**
  replay movies, **48**
  run, **47, 48**
  start recording, **47, 48**
Natural sky color, **55**
Names, see Labels
Nebulae, see Deep Sky Objects
Object
  center on, **26, 28**
  default search settings, **55**
  Ephemerides, **29**
  find & center, **27**
  find object dialog, **8, 27**
  lock on, **27**
  show information on, **8, 28**
  technical data, **8, 28**
  type, **27, 28**
  window, **28**
Object Filters Group
  dialog, **9**
Observing from, see Location
Panel
  direction, **7**
  filter, **8**
  status, **7**
  control, **5**
Panels
  menu, **5**
  settings, **5**
Photo gallery
  browse, **46**
  colors, **46**
  contents list, **46**
  find photo, **46**
  index, **46**
  open, **45**
  search, **46**
  search history, **46**
Planets
  atmosphere, **37**
  center on, **26, 35, 36**
  display, see Panel, filter
  distance from, **31, 33, 35**
  filter, **32, 34**; see also Planet, filter dialog
  filter dialog, **37**

find, **27**
follow planet, **33, 62**
grids, **37**
image size, **6**
images, **37, 63**
labels, **37**
label master button, **37**
lock view on, **35, 36**
magnification sliders, **37**
map dialog, **21**
moons of, **37**
move around, **31, 62**
orbits of, **33**
orbit master button, **37**
phases of, **37**
position in relation to, **31, 33**
real colors, **37**
rotation, **31, 35**
rotation about axis, **37**
rotation about Sun, **37**
satellites of, **37**
select, **31, 33**
show, **37**
unlock view from, **35**
Pointing, see Direction
Precession, **18**
Preferences, **49**
Print
setup, **56**
Printing
Ephemerides, **29**
reports; see Reports
sky chart information, **56**
sky chart legend, **56**
sky charts, **56**
white sky, **56**
Projections
mercator, **30**
polar, **30**
Reports
altitude at transit, **52**
Moon parameters, **52**
object visibility, **51, 52**
print visibility reports, **51, 52**
rise and set of object, **51**
Reports, planetary
distance from observer, **53**
elongation angle, **54**
illumination, **54**
magnitudes, **54**
visibility, **53**
visible diameter, **54**
Restore, see Save & restore
Right Ascension, **25**
Save & restore
current view, **57-58**
file types, **57-58**
settings, **57-58**
Search for object, see Object, find object dialog
Settings panel
icons, **6**
Size box, **5**
Sky charts, see Printing
Solar eclipse, see Eclipse
Special objects, **23-24**
Star aberration, **55**
Star proper motion, **55**
Stars, **7, 63**
catalogs, **10**
display, **10**; see also Panel, filter
filter dialog, **10**
find, **27**
labels, **10**
luminosity, **10**
magnitude, **10**
mark binaries, **10**
mark variables, **10**
multiple, **10**
spectra, **10**
variable, **10**
Surface maps, see Maps
Telescope views, **30**
Time
civil, **18, 59**
control, **17**
control panel, **17**
daylight saving, **18, 59**
epoch, see Epoch
Greenwich mean, **17, 59**
local, **17**
precession, see Precession
reset, **17**
run real time, **49, 60**
set new date, **17**
set new time, **17**
settings panel, **17**
sidereal, **17**
start, **18, 60**
step, **31**
stop, **18**
tracking, **17, 18, 60**
universal, **17, 59**
zone **18, 59**
Tutorials, **44**
default settings, **6**
instructions panel, **6, 44**
window, **6**
Views and projections, **30**
Views, Horizon, **30**
Views, Equatorial, **30**
Views, Ecliptic, **30**
Views, Galactic, **30**
Views, Atlas see Projections
View from, see Location
What's new in RedShift 2, **4**
Zoom
-dependent filtering, **10**
factor, **7, 62**
in, **8**
out, **8**
settings panel, **7**; see also Panel, zoom settings